

Roll No.

Total No. of Pages : 02

Total No. of Questions : 08

B.Tech. (CSE / IT) (2018 & Onwards) (Sem.-1)

MATHEMATICS-I

Subject Code : BTAM-104-18

M.Code : 75362

Time : 2 Hrs.

Max. Marks : 30

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE question(s), each question carries 6 marks.

- 1) a) Expand $f(x) = e^{\sin x}$ upto the term containing x^4 .
b) Show that $f(x) = \sin x (1 + \cos x)$ has a maximum at $x = \pi/3$.
- 2) a) Find the volume of the solid generated by revolving $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a > b$ about the major axis.

b) Using Gamma function evaluate $\int_0^{\infty} \sqrt{x} \exp(-3\sqrt{x}) dx$.

3) a) If $A = \begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & -2 \\ 1 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$, then show that $(AB)C = A(BC)$.

b) Solve the equations using Cramer rule $2x + 3y + 4z = 11, x + 5y + 7z = 15, 3x + 11y + 13z = 25$.

4) a) Find the rank of the matrix $\begin{bmatrix} -8 & 1 & 4 \\ 4 & 4 & 7 \\ 1 & -8 & 4 \end{bmatrix}$.

b) Solve using Gauss elimination method $x - y + 2z = 3, x + 2y + 3z = 5, 3x - 4y - 5z = -13$.

5) a) Express $v = (2, -5, 3)$ in \mathbb{R}^3 as a linear combination of vectors $u_1 = (1, -3, 2), u_2 = (2, 4, -1), u_3 = (1, -5, 7)$.

b) Determine whether the vectors $u_1 = 2t^2 + 4t - 3$ and $u_2 = 4t^2 + 8t - 6$ are linearly dependent?



6) a) Suppose the mapping $F : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ is defined by $F(x, y) = (x + y, x)$.

Using the properties of matrices, show that F is a linear mapping.

b) Find the dimension and a basis of the subspace W of $P_3(t)$ spanned by

$$u = t^3 + 2t^2 - 3t + 4, v = 2t^3 + 5t^2 - 4t + 7, w = t^3 + 4t^2 + t + 2.$$

7) Find the characteristic equation of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and hence compute A^{-1} .

8) Reduce the matrix $\begin{bmatrix} 5 & 3 & 7 \\ 3 & 26 & 2 \\ 7 & 2 & 10 \end{bmatrix}$ to the diagonal form.

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Total No. of Pages : 02

Total No. of Questions : 08

B.Tech. (CE/ME/ECE/EE) (2018 & Onward) (Sem.-1)

MATHEMATICS-I

Subject Code : BTAM-101-18

M.Code : 75353

Time : 2 Hrs.

Max. Marks : 30

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE question(s), each question carries 6 marks.

1. a) Expand $f(x) = e^{\alpha \sin^{-1} x}$ in ascending powers of x upto x^4 .
b) Evaluate $\lim_{x \rightarrow 0} \frac{e^x - e^{-x} - 2 \log(1+x)}{x \sin x}$.
2. a) Find the maximum value of $\sin^p x \cos^q x$.
b) Find the volume of the solid generated by revolving the curve $xy^2 = 4(2-x)$ about y -axis.
3. a) If $u(x, y) = \frac{x^2 + y^2}{x + y}$, then prove that $\left(\frac{\partial u}{\partial x} - \frac{\partial u}{\partial y}\right)^2 = 4\left(1 - \frac{\partial u}{\partial x} - \frac{\partial u}{\partial y}\right)$.
b) Find the maximum and minimum values of $x^3 + 3xy^2 - 3y^2 + 4$.
4. a) Evaluate $\int_0^a \int_0^{\sqrt{a^2 - y^2}} (x^2 + y^2) dx dy$ after changing into polar coordinates.
b) Evaluate $\iint_R (x+y) dx dy$ where R is the region bounded by $x = 0, x = 2, y = x, y = 2+x$.
5. a) Examine the convergence of the series $\sum_{n=1}^{\infty} \frac{1}{n^p}$ when $|p| \leq 1$.
b) Examine the series $1 + \frac{1}{2^2} + \frac{2^2}{3^3} + \frac{3^3}{4^4} + \dots$ for convergence.



6. a) Examine $\frac{1}{1.2.3} + \frac{1}{2.3.4} + \frac{1}{3.4.5} + \dots$.
- b) Examine the series $\frac{x}{1+x} - \frac{x^2}{1+x^2} + \frac{x^3}{1+x^3} - \dots$, $0 < x < 1$ for convergence.
7. a) Determine whether the vectors $u = (1, 2, 3)$ and $v = (7, -4, 2)$ are linearly dependent?
- b) Solve the system of linear equations $3x + y + 2z = 3$, $2x - 3y - z = -3$, $x + 2y + z = 4$.
8. Find the characteristic equation of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and hence compute A^{-1} . Also express the matrix represented $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$.

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Roll No.

Total No. of Pages : 02

Total No. of Questions : 16

Bachelor of Science (Graphics & Web Designing) (Sem.-1)

OBJECT ORIENTED PROGRAMMING USING C++

Subject Code : UGCA-1909

M.Code : 77730

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains SIX questions carrying TEN marks each and students have to attempt any FOUR questions.

SECTION-A

Write briefly :

1. What are the advantages of object oriented programming?
2. What is a destructor?
3. How is the memory allocated to an object?
4. What are sequential access files?
5. Write the importance of Header files.
6. What is function? Write the structure of function.
7. Define Scope.
8. Explain about Nested Classes.
9. Define Friend Function.
10. What are different file opening Modes? Discuss.

82

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SECTION-B

11. Differentiate between C and C++.
12. Explain about the different types of methods to pass an argument to a function with an example.
13. Write program to overload << and >> operators in complex numbers.
14. Differentiate between virtual function and virtual class. Also explain the rules for virtual function.
15. What are different types of inheritance in C++? Explain with an example.
16. What is Constructor Overloading? Give examples.

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Dec 2020



Roll No.

Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (ECE) (2018 & Onwards) (Sem.-1,2)
SEMI-CONDUCTOR AND OPTOELECTRONICS PHYSICS
Subject Code : BTPH-105-18
M.Code : 75363

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Write briefly :

- Q1. What is the difference between classical and quantum theory of free electrons?
- Q2. What is Fermi energy? Write down its relation with concentration of electrons in metals.
- Q3. State Bloch's theorem for a periodic system.
- Q4. Explain why the conductivity of a pure semiconductor increases with temperature while that of a metal decreases.
- Q5. Explain Fermi-Dirac distribution function. Plot this function for various temperatures including 0 K.
- Q6. What is Schottky diode?
- Q7. Explain the term absorption and spontaneous emission of radiation.
- Q8. What property of materials can be measured with Hot-point probe?
- Q9. What is the avalanche photodetector?
- Q10. What physical parameters can be known from I-V characteristics of diode?

21 19

SECTION-B

- Q11. Solve the Schrodinger wave equation for particle in a box and obtain its energy levels. Show that the eigenvalues of energy are discrete. [8]
- Q12. Discuss the motion of electrons in a region of periodic potential and how it lead to explain the occurrence of allowed and disallowed energy regions. [8]
- Q13. Obtain an expression for the carrier density of an intrinsic semiconductor. Explain how the resistivity of an intrinsic semiconductor varies with temperature. [5+3=8]
- Q14. (a) What do you mean by carrier generation and recombination process? [4]
- (b) Explain the terms: barrier energy, barrier potential and depletion region, as applied to a p-n junction. [4]

SECTION-C

- Q15. What is a semiconductor laser? Discuss in detail the lasing action in semiconductor laser with necessary diagram. [2+6=8]
- Q16. What are light emitting diodes? Discuss the structure and characteristics of LEDs. [2+6=8]
- Q17. Discuss in detail the working principles of p-i-n photodiode and its characteristics. [8]
- Q18. Explain in detail about the measurement of carrier density, resistivity and hall mobility by four probe method. [8]

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Total No. of Questions : 18

B.Tech (2012 to 2017) (Sem.-1,2)
FUNDAMENTALS OF COMPUTER PROGRAMMING AND IT
Subject Code : BTCS-101
M.Code : 54095

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONA TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer briefly :

1. What are peripheral devices? Explain with examples.
2. What is the difference between RAM and ROM?
3. What is recursion? What is its advantage?
4. Write a program to find the average of 5 numbers.
5. Differentiate between primary and secondary memory.
6. What is the continue statement in C used for?
7. What are spreadsheets?
8. What is data abstraction?
9. What do you mean by if-else ladder?
10. How do you read a file in a C program?

24

SECTION-B

11. What is an operating system? List its types and functions.
12. What features should be used while preparing PowerPoint presentations?
13. What is switch statement? Write a C program to check whether number is EVEN or ODD using switch statement.
14. Write a note on the evolution of Internet. What are a few applications of internet?

SECTION-C

15. What are the different forms of inheritance supported by C++? Explain them with an example.
16.
 - a) What are objects? How are they created?
 - b) What is a constructor? Is it mandatory to use constructors in a class?
17. Explain the following :
 - a) Default arguments in C++
 - b) Multidimensional arrays
 - c) String Manipulation functions in C
 - d) Error handling during file operations in C++
18. Differentiate between Call by value and Call by reference. Explain using examples.

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Dec 2020

Roll No.

Total No. of Questions : 18

Total No. of Pages : 02



B.Tech. (2012 to 2017) (Sem.-1,2)

ENVIRONMENTAL SCIENCE

Subject Code : EVSC-101

M.Code : 54107

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Write briefly :

1. Define Deforestation.
2. What is Bio-sphere?
3. Give full form of AIDS.
4. What is red data book?
5. Define Ozone layer.
6. What is population explosion?
7. Define sustainable development.
8. Name two basic food groups.
9. Give two examples of Renewable energy.
10. What is water logging?

28
10

SECTION-B

11. Discuss the strategies and measures you will adopt, to control floods.
12. What is Ecological succession? Mention in detail about causes of Ecological succession.
13. Discuss in detail about 'Case studies of Forest Resources and Water Resources.'
14. Write in detail about Multidisciplinary nature of environment highlighting the importance in context with present day scenario.

SECTION-C

15. What is Value Education? Why is it necessary? What steps government is taking to improve values of younger generation?
16. Discuss role of Information Technology in environment & human health.
17. Write a note on 'Environment Protection Act.'
18. What is the importance of Rain water harvesting? How the concept of RWH is useful in protecting our environment?

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Dec 2020

Roll No.

Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (CSE/IT) (2018 & Onwards) (Sem.-1,2)

SEMI-CONDUCTOR PHYSICS

Subject Code : BTPH-104-18

M.Code : 75360



Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Write briefly :

- Q1. The energy of an electron in a metal is quantised. Explain.
- Q2. Discuss the physical significance of the wave function Ψ .
- Q3. Explain Fermi-Dirac distribution function. Plot this function for various temperatures including 0 K.
- Q4. Explain the significance of Brillouin zone with particular reference to any cubic lattice.
- Q5. What do you mean by effective mass of electron?
- Q6. How photonic devices work.
- Q7. What are the differences between stimulated and spontaneous emission?
- Q8. Why four probes are required for the measurement of resistivity of semiconductor in four probe method.
- Q9. What is Schottky barrier diode?
- Q10. What is exciton?

28

SECTION-B

- Q11. Discuss quantum theory of free electrons in metals. Derive an expression for the fermi energy at absolute zero. [8]
- Q12. What is the effect of periodic potential on the energy of electrons in a metal? Explain it on the basis of Kronig Penny model and explain the formation of energy bands. [8]
- Q13. Derive an expression for the densities of electrons and holes in the conduction and valence bands respectively of an intrinsic semiconductor [8]
- Q14. (a) What are n-type and p-type semiconductors? Show the acceptor and donor levels with neat diagram. [4]
- (b) Explain with diagrams forward and reverse biasing of a p-n junction. What is meant by avalanche breakdown? [4]

SECTION-C

- Q15. What do you mean by population inversion? Obtain a relation between transition probabilities of spontaneous and stimulated emission. [3+5=8]
- Q16. How does a semiconductor laser differ from other laser? Explain main features of the semiconductor laser and its applications. [8]
- Q17. What is photoconductivity? Explain principle and construction of a photovoltaic cell. [2+6=8]
- Q18. What physical parameters can be measured from capacitance-voltage measurements? Describe a method for the measurement of divergence and wavelength of light. [3+5=8]

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Roll No.

Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (2012 to 2017) (Sem.-1,2)

ENGINEERING PHYSICS

Subject Code : BTPH-101

M.Code : 54105

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Write briefly :

1. What do you mean by a rotational and irrotational field?
2. Give the expression for Poynting vector and its physical significance.
3. Differentiate between Type-I & Type-II superconductors.
4. Define terms: unit cell, basis and space lattice.
5. Write about the basic components of a laser system.
6. What do you understand by material dispersion and pulse broadening in optical fibres?
7. Write Einstein's two postulates of special theory of relativity.
8. Derive the energy-momentum relationship.
9. What do you understand by eigen functions & eigen values in quantum mechanics?
10. What is the surface to volume ratio at nanoscale?



SECTION-B

11. a) Discuss different types of polarization in dielectrics. 3
b) Write Maxwell's equations in free space in their integral form. 2
c) Explain Electromagnetic spectrum giving basic ideas of different regions. 3
12. What is a superconducting state of a substance? Explain superconductivity on the basis of BCS theory. 8
13. a) Differentiate between continuous and characteristic X-rays. 3
b) Discuss briefly the experimental method for crystal structure determination by X-ray diffraction. 5
14. a) Differentiate between three & four level laser systems. 3
b) Discuss the construction, working and energy level diagram of He-Ne Ruby laser. 5

SECTION-C

15. a) Discuss the propagation mechanism of light waves in optical fibre. 2
b) What are single mode, multimode and graded index fibres? 3
c) Write a short note on the applications of optical fibres. 3
16. a) Explain the construction, working and result of Michelson Morley experiment. 5
b) Derive the expression for addition of velocities under relativistic motion. 3
17. a) By giving suitable examples, explain the need and origin of quantum mechanics. 4
b) Derive time-independent Schrodinger wave equation. 4
18. a) Discuss the basic difference between 0D, 1D, 2D and 3D nanomaterials. 4
b) What do you understand by carbon nanotubes and methods for their synthesis? 4

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Roll No.

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (2012 to 2017) (Sem.-1,2)

ENGINEERING DRAWING

Subject Code : BTME-102

M.Code : 54102

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions EACH from SECTION - B & C.

SECTION-A

Answer briefly/Fill in the blanks :

1. Sketch a symbolic line that represent center line, lines of symmetry and trajectories
2. Construct a scale of 1:5 to show decimeters and centimeters to read up to 1 m. Show the length of 6.7 decimeter on it.
3. Sketch the symbol for third angle projection.
4. Why first & third angle projections are preferred over the second & fourth angle projection system?
5. What is octant and write basic steps to open an octant?
6. What are the auxiliary planes?
7. Explain the term 'Shortest Distance' of a point.
8. What is the difference between isometric and orthographic projections?
9. What is the difference between truncated and oblique solids?
10. What is the significance of a trace of a line?



SECTION-B

11. A point P is 40 mm below HP, in third quadrant, and its shortest distance from XY line is 55 mm. Draw its front and top view.

12. Projectors drawn through HT and VT of a line AB are 80mm apart and those drawn through its ends A and B are 50 mm apart. HT (H) is located 45 mm behind the VP and VT (V') 70 mm below the HP. The end A of the line lies in the HP. Draw the projection of the line and determine its TL, θ and ϕ .
13. A right regular pentagon ABCDE of 40 mm side, has its corner A on HP. Its side CD parallel to HP and inclined at 45° with the VP. The plane of the pentagon makes an angle of 35° with the HP. Draw its projection keeping its corner point C 70 mm in front of VP.
14. A right regular pentagonal pyramid, edge of base 30 mm and height 60 mm, is held on ground plane on one of its corner, such that its axis is inclined at 45° to HP and 30° to VP. Draw its projection in third angle.

SECTION-C

15. A right circular cone, diameter of base 55 mm and height 80 mm, rests on ground plane on its base. A bee starts from a point on right side of the base rim and moves around the surface of the cone and finally comes back to the starting point. Find the length of the shortest path the bee should take in covering the distance along the surface of the cone. Also show the path in front and top views.
16. A right circular cone, base diameter 56 mm and height 66 mm, resting on its base on HP, is completely penetrated by a cylinder of diameter 30 mm. The axis of the cylinder is parallel to both the HP and VP and intersects the axis of the cone at a distance of 20 mm from the base. Draw the projection of the solid showing curves of intersection. Assume any suitable length of the penetrating cylinder.
17. Draw isometric projection from front view and top view as shown in Figure below :

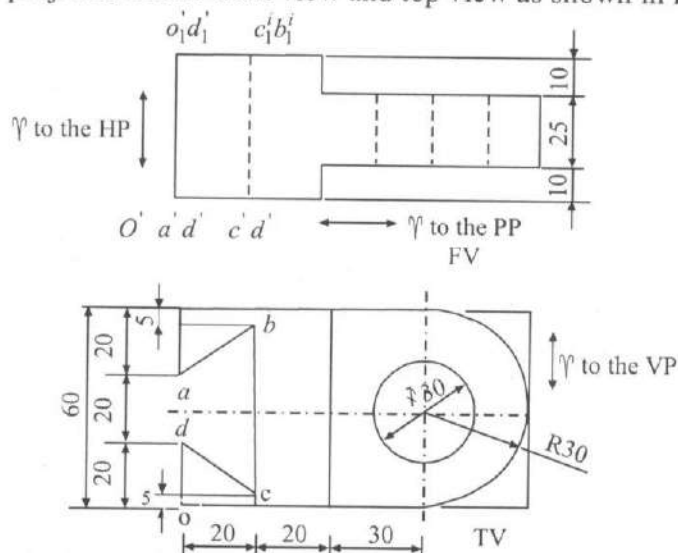


FIG.1

18. Draw the orthographic views i.e. front view, top view and side view of the figure shown below.

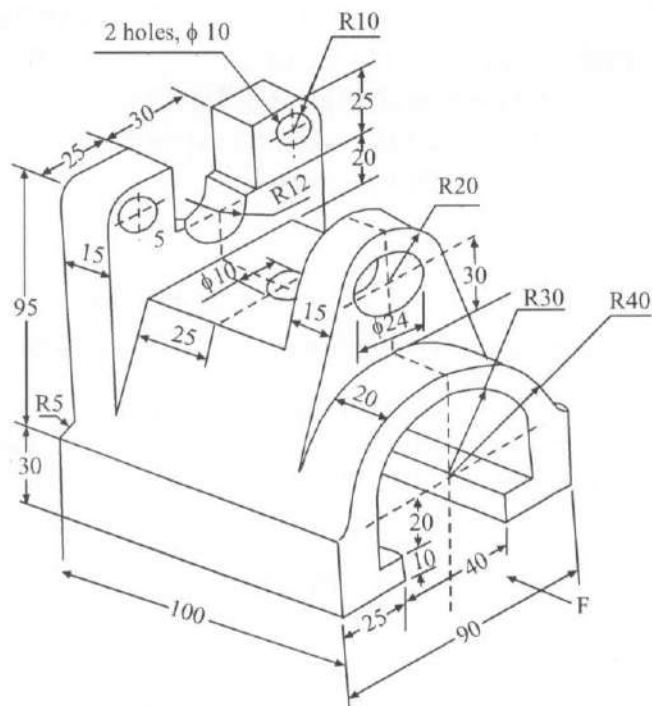


FIG.2

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Roll No.

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (Chemistry Group) (2018 & Onwards) (Sem.-1,2)

CHEMISTRY-I

Subject Code : BTCH-101-18

M.Code : 75343

Time : 3 Hrs.

Max. Marks : 60

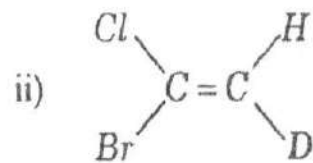
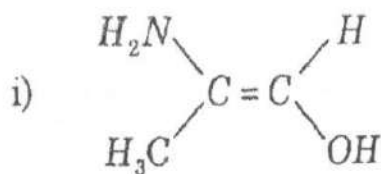
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3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer briefly :

1. Which have high melting point and why ;
 HgCl_2 or CaCl_2
2. Why is TMS used as an internal standard in NMR spectroscopy?
3. Define e.m.f. of cell.
4. Write down the equation of state of real gas.
5. Give cis and trans notation to the following :



6. How do you explain anomalous electronic configuration of Cu ($4s^1 3d^{10}$)?
7. Can oxidation state be negative? Discuss.

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Dec. 2020

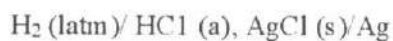
8. Give one example of Hard and soft acid each.
9. What is isomerism?
10. For a cell reaction $A(s) + 2B(aq) \rightarrow A^{2+}(aq) + 2B(s)$ at 298 K, the equilibrium constant is 1.0×10^4 . Calculate E° cell.

SECTION-B

11. a) Solve the Schrodinger wave equation for particle in one-dimensional box. (6)
 b) Give the physical meaning of wave function. (2)
12. What is crystal field theory? How does this theory account for the fact that $[CoF_6]^{3-}$ is paramagnetic but $[Co(NH_3)_6]^{3+}$ is diamagnetic though both are octahedral.
13. a) What are vander Waals forces? Discuss them briefly. (5)
 b) The vander Waals constants of a gas are: $a=0.751 \text{ dm}^6 \text{ atm mol}^{-2}$ and $b=0.0226 \text{ dm}^3 \text{ mol}^{-1}$. Calculate critical constants. (3)
14. a) Explain Principles of UV-Vis Spectroscopy. How do you distinguish between different types of transitions involved in UV-Vis spectroscopy? (5)
 b) On the basis of IR spectroscopy, how can you distinguish between the following : (3)
 - i) Alkane, alkene and alkyne
 - ii) Aldehyde and ketone

SECTION-C

15. a) Derive Nernst equation. (4)
 b) Calculate the mean ionic activity co-efficients of 0.1 mol/kg HCl, given the e.m.f of the cell :



is 0.3524V and that standard electrode potential of Ag-AgCl is 0.2224V at 25°C. (4)

16. a) Discuss the molecular geometries of the following :
- i) BCl_3
 - ii) PCl_5
- (Atomic number: B = 5, P = 15) (4)
- b) What is effective nuclear charge? Which element has the highest effective nuclear charge? (2)
- c) What is ionization energy? Which elements have the highest ionization energy? (2)
17. Explain the following terms :
- a) Chirality (2)
 - b) Enantiomers (2)
 - c) Diastereomers (2)
 - d) Optical activity (2)
18. a) Discuss the synthesis of a commonly used drug molecule by taking a suitable example. (4)
- b) Write short notes on the following organic reactions :
- i) Oxidation reactions (2)
 - ii) Ring opening reactions (2)

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Roll No.

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (2012 to 2017) (Sem.-1,2)
ENGINEERING CHEMISTRY
Subject Code : BTCH-101
M.Code : 54093

Time : 3 Hrs.

Max. Marks : 60

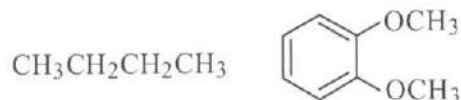
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2. SECTION-B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C Each.

SECTION-A

Answer briefly :

1. How many signals would you expect to see in the ^1H NMR spectrum of the following :



2. How are salts responsible for the temporary and permanent hardness of water? Explain.
3. State Beer-Lambert Law.
4. What are concentration cells?
5. State the law of photochemical equivalence.
6. Define Atom Economy.
7. Why does $\text{Mg}(\text{HCO}_3)_2$ require double amount of lime for softening?
8. Define Molecular self Assembly.
9. What is the importance of finger print region in IR spectroscopy?



Dec 2020

10. "Iron does not rust when zinc coating is broken in a galvanized iron pipe but rusting occurs if a coating of tin over iron is broken". Why?

SECTION-B

11. a) Explain any two principle's of Green Chemistry with the help of examples. (5)
- b) Elaborate the statement -"Microwave heating as a Greener Technology". (3)
12. a) Calculate the amount of lime (84% pure) and Soda (92% pure) required for treatment of 20,000 liters of water, whose analysis is as follows $\text{Ca}(\text{HCO}_3)_2 = 40.5$ ppm; $\text{Mg}(\text{HCO}_3)_2 = 36.5$ ppm; $\text{MgSO}_4 = 30.00$ ppm; $\text{CaSO}_4 = 34.0$ ppm; $\text{CaCl}_2 = 27.75$ ppm and $\text{NaCl} = 10.00$ ppm. Also calculate the temporary and permanent hardness of water. (4)
- b) What are lime and soda processes? Compare hot and cold soda lime process for softening of hard water. (4)
13. a) How do you distinguish between different types of transitions involved in UV-Vis spectroscopy? (4)
- b) How many NMR signals are observed in the spectrum of : (4)
- i) $\text{CH}_3\text{COOCH}_3$
- ii) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{CH}_3$
- iii) CH_3OCH_3
- iv) $\text{CH}_3\text{CH}_2\text{CH}_3$
14. a) Draw a well labelled Jablonski diagram and explain : (2)
- i) Intersystem crossing (2)
- ii) Phosphorescence (2)
- iii) Fluorescence (2)
- b) A solution shows a transmittance of 20% when taken in a cell of 2.5 cm thickness. Calculate its concentration, if the molar absorption coefficient is $12,000 \text{ dm}^3\text{mol}^{-1}\text{cm}^{-1}$. (2)

SECTION-C

15. a) Explain the mechanism of following types of corrosion :
- i) Galvanic corrosion (2)
 - ii) Wet corrosion (2)
- b) What are the various methods that needs to be followed to control corrosion? (4)
16. a) What are different type of polymerization reactions? Give examples. (4)
- b) How does molecular weight affect the properties of polymer? (4)
17. Write a short note on **any two** of the following : (4×2=8)
- a) Classification of crude oil
 - b) Properties of natural gas
 - c) Raw material for petrochemicals
18. a) What are self assembling materials? Also discuss mesoscale self assembly. (4)
- b) Discuss the potential applications of nanomaterial in coming future. (4)

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Dec 2020

Roll No.

Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (All Branches Physics Group) (2018 & Onwards) (Sem.- 1, 2)

BASIC ELECTRICAL ENGINEERING

Subject Code : BTEE-101-18

M.Code : 75339

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

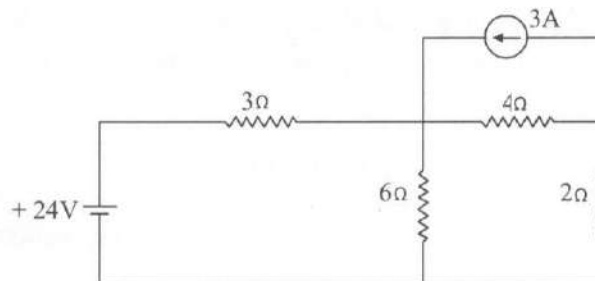
Answer following questions in brief :

- 1) What is an ideal Transformer?
- 2) Define Peak Factor and Form Factor.
- 3) State KCL.
- 4) How will you convert voltage source into current source and vice-versa.
- 5) What is difference between Synchronous Motor and Induction Motor?
- 6) Draw and explain BH curve.
- 7) Draw Phasor diagram for purely capacitive circuit.
- 8) Why can't we operate transformer on DC?
- 9) Define superposition theorem.
- 10) What do you mean by SLIP?



SECTION-B

- 11) Define resonance. Derive the expression for resonant frequency for parallel LCR circuit.
- 12) The iron loss and full load copper loss of 100KVA, 6600/400Volts single phase transformer are 600Watts and 900 Watts. Calculate the efficiency at full load and half load at 0.8 power factor lag. Calculate the load at which maximum efficiency is obtained and its magnitude at some power factor.
- 13) Explain principle, construction and working of a synchronous generator with suitable sketches.
- 14) State Norton's Theorem, Find the current through 2 ohm resistor using Norton's Theorem.



SECTION-C

- 15) Explain the relation between line values and Phase values of voltage and current for 3-Phase balanced star connected system and sketch the phasor diagram.
- 16) State advantages, disadvantages and application of auto transformer.
- 17) Explain any two methods of speed control of slip ring 3-Phase induction motor.
- 18) Explain the necessity of Earthing in an electrical installation. Also state the points to be earthed in internal/wiring system of a residential building.

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Dec 2020



Roll No.

Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (Mechanical Engg.) (2018 & Onwards) (Sem.-1,2)

ELECTROMAGNETISM

Subject Code : BTPH-103-18

M.Code : 75357

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Write briefly:

- Q1. From the expression of electric field for a continuous volume charge distribution, prove that $\nabla \cdot E = \frac{1}{\epsilon_0} \rho$, where symbols have their usual meanings.
- Q2. Derive the Laplace and Poisson's equations.
- Q3. What do you understand by Electric displacement?
- Q4. Give the Physical significance of divergence and curl of static magnetic field.
- Q5. Derive the expression $H = \frac{1}{\mu_0} B - M$ where symbols have their usual meanings.
- Q6. Mention the importance of Lenz's law in explaining Faraday's law of induction.
- Q7. Derive the continuity equation in terms of volume current density.
- Q8. Differentiate between potential and electromotive force.
- Q9. Write Maxwell's equations in vacuum in their integral form.
- Q10. Differentiate between linear, circular and elliptical polarization.

6

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SECTION-B

- Q11. a) Define Uniqueness theorem for Dirichlet and Neumann boundary conditions. 3
b) Derive the expression for electrostatic energy of a charge distribution in vacuum in terms electric field and comment about its (electrostatic energy) characteristics. 5
- Q12. Derive the expression for potential and electrostatic field due to an electric dipole. 8
- Q13. a) Explain the concept of magnetic vector potential. Under what conditions it can be considered as a scalar? 3
b) Discuss the process of magnetization and derive the expression for associated bound currents due to magnetization. 5
- Q14. a) Make a comparison between the characteristics of diamagnetic, paramagnetic and ferromagnetic materials. 4
b) Derive the expression for magnetic field due to a bar magnet. 4

SECTION-C

- Q15. a) Derive the expression for energy stored in a magnetic field. 5
b) How the Ampere's circuital law ($\nabla \times B = \mu_0 J$) was modified for time-dependent electric field. 3
- Q16. State Poynting's theorem of electromagnetism and prove it. 8
- Q17. a) What do you understand by uniform plane waves, give wave equations in terms of E and B and prove the transverse nature of EM waves. 5
b) Derive the relation between electric and magnetic fields of an EM wave. 3
- Q18. Derive the expressions for Reflection and transmission of EM waves from a non-conducting medium-vacuum interface for normal incidence. 8

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Roll No.

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Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (Bio Tech) (2018 & Onwards) (Sem.-1,2)
INTRODUCTION TO PHYSICS IN BIOTECHNOLOGY

Subject Code : BTPH-107-18

M.Code : 75369

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer briefly :

- Q1. State the principle and working of a laser.
- Q2. Explain the conditions for total internal reflection phenomena.
- Q3. Mention various fiber parameters.
- Q4. Differentiate between soft and hard magnetic materials.
- Q5. Differentiate between type-I and type-II superconductors.
- Q6. Justify that "*Meissner effect is the true verification of superconducting state*".
- Q7. Give the difference between continuous and characteristic X-rays.
- Q8. Mention properties of ultrasound waves.
- Q9. Explain the concept of wave-particle duality.
- Q10. What is the difference between a quantum wire and quantum dot?

SECTION-B

858

- Q11. a) Explain the construction, working and energy diagram of Ruby laser. 5
b) Discuss some medical applications of lasers. 3
- Q12. a) Discuss the construction and working of step and graded index fibers. 5
b) Discuss different losses associated with optical fibers and their control. 3
- Q13. a) Make a comparison between the characteristics of dia, para, ferro, ferri and ferrite magnetic materials. 5
b) Explain the phenomena of magnetostriction and mention its few applications. 3
- Q14. a) Discuss the superconducting state and its various properties. 4
b) Give a brief account of BCS theory of superconducting state. 4

SECTION-C

- Q15. Give an account of the properties of X-rays and discuss the method of their production. 8
- Q16. a) Explain the principle and working of ultrasound generator. 5
b) Mention the adverse effect of ultrasound waves. 3
- Q17. a) Write a short note on de-Broglie waves and their properties. 3
b) Give definitions of Photoelectric effect and Compton Effect. 3
c) Calculate the frequency and wavelength of a photon whose energy is 75eV. 2
- Q18. a) Discuss the top-down and bottom-up methods of nanoparticles synthesis. 4
b) What are carbon nanotubes? Discuss how various types of carbon nanotubes can be formed from graphene? 4

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Roll No.

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (2012 to 2017) (Sem.-1, 2)
ELEMENTS OF MECHANICAL ENGINEERING
Subject Code : BTME-101
M.Code : 54101

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer briefly / Fill in the blanks :

- 1) Define a Thermodynamics System.
- 2) Explain briefly zeroth law of thermodynamics.
- 3) What is Triple Point?
- 4) Define Internal Energy.
- 5) What do you mean by PMM of first kind?
- 6) Explain the concept of available and unavailable energy.
- 7) What is Air Standard Efficiency?
- 8) Define the term True Stress.
- 9) Under what conditions the center of mass and center of gravity coincide?
- 10) What is the difference between thermoplastic and thermosetting materials?

~~29~~ 16

SECTION-B

- 11) To a close system 150kJ of work is supplied. If the initial volume is 0.6 m^3 and the pressure of the system changes as $p= 8-4V$, where p is in bar and V is in m^3 , determine the final volume and pressure of the system.
- 12) 0.1 m^3 of an ideal gas at 300K and 1 bar is compressed adiabatically to 8 bar. It is then cooled at constant volume and further expanded isothermally so as to reach the condition from where it started. Calculate :
- Pressure at the end of constant volume cooling
 - Change in internal energy during constant volume process
 - Net work done and heat transferred during the cycle. Assume $C_p = 4.3 \text{ kJ/kg K}$ and $C_v = 10.2 \text{ kJ/kg K}$.
- 13) Write down the general energy equations for steady flow system and simplify when applied to the following :
- Centrifugal water pump
 - Steam nozzle
- 14) A closed system contains at a pressure 1 bar, temperature 300 K and volume 0.018 m^3 . This system undergoes a thermodynamics cycle consisting of the following three processes in series :
- Constant volume heat addition till pressure becomes 5 bar,
 - Constant pressure cooling
 - Isothermal heating to initial state

Represent the cycle on T-S and p-V plots and evaluate the change in entropy for each process. $C_p=0.718 \text{ kJ/kg K}$ and $R = 0.287 \text{ kJ/kg}$

20 17

SECTION-C

- 15) An engine of 250 mm bore and 375 mm stroke works on otto cycle. The clearance volume is 0.00263 m^3 . The initial pressure and temperature are 1 bar and 50°C . If the maximum pressure is limited to 25 bar, find the following :
- Air standard efficiency of the cycle
 - The mean effective pressure of the cycle, Assume the ideal conditions.
- 16) Discuss briefly the method employed for improvement of thermal efficiency of open cycle gas turbines.
- 17) Discuss the following properties of the materials :
- Ductility
 - Resilience
 - Weldability
 - Plasticity
- 18) Determine the moment of inertia of a semicircular arc about its diameter and hence locate its centroid.

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Roll No.

Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (2012 to 2017) (Sem.-1,2)
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
Subject Code : BTEE-101
M.Code : 54097

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer briefly :

1. Find the average value of periodic sine wave for complete cycle which is clamped to half its positive maximum value.
2. Explain Statically & Dynamically induced EMF with examples.
3. Explain commutator working in DC Motor.
4. Establish condition of maximum efficiency in a single-phase transformer in terms of losses.
5. Establish relation of power consumed in balanced 3 phase load.
6. Convert $(689)_{10}$ into hexadecimal.
7. Compare between an active and a passive transducer.
8. Give the energy band diagram for a semiconductor, insulator and conductor.-
9. Implement an XOR gate using NOR gates only.
10. Explain RH screw rule with application.

~~25~~
12

SECTION-B

11. a) Define Work, Power & Energy. Write down their units in Electrical, mechanical & thermal sense.
b) Convert delta connected set of 3 resistors R into star.
12. a) Establish relation between Line & phase current in case of balanced 3 phase delta connection.
b) Establish relation of power consumed in balanced 3 phase load.
13. Explain principle, construction and working of synchronous generator with suitable sketches.
14. Find the average value of sine wave for complete cycle which is clamped to half its negative maximum value.

SECTION-C

15. Explain construction & working of LVDT in detail.
16. Explain the energy band description of semiconductor. List the properties of semiconductor also.
17. Explain the principle of operation and the characteristics of FJT.
18. Implement the following logic expression with logic gates :

$$Y = ABC + AB + BC$$

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Roll No.

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (CSE/IT) (2018 & Onwards) (Sem.-2)

MATHEMATICS-II

Subject Code : BTAM-204-18

M.Code : 76257

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer the following :

1. Give any four characteristics for an ideal measure of dispersion.
2. Define skewness.
3. A bag contains 3 red, 6 white and 7 blue balls. What is the probability that two balls drawn are white and blue?
4. Give the formula of mean and standard deviation for Binomial distribution.
5. Write any four properties of normal distribution.
6. Find the coefficient of correlation of two uncorrelated variables x and y .
7. Write the normal equations for the curve $x = b + cy$.
8. Define sampling error and confidence interval.
9. Define Type-I error.
10. Define degrees of freedom.

28

SECTION-B

11. a) Calculate standard deviation from the table giving age distribution of 542 members :

Age group	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of members	3	61	132	153	140	51	2

b) The first four moments of a distribution about the value 4 of the distribution are -1.5 , 17 , -30 and 108 . Find the moments about mean.

12. a) Estimate $E(X)$ and $E(X)^2$ from the following probability distribution :

X	-3	6	9
P(X)	1/6	1/2	1/3

b) A can hit a target 3 times in 5 shots, B 2 times in 5 shots and C 3 times in 4 shots. All of them fire one shot each simultaneously at the target. What is the probability that (i) 2 shots hit (ii) at least 2 shots hit?

13. a) During war 1 ship out of 9 was sunk on an average in making a certain voyage. What was the probability that (i) exactly 3 out of a convoy of 6 ships would arrive safely (ii) a minimum of 7 ships would arrive safely.

b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which (i) neither car is used, and (ii) some demand is refused.

14. a) If X is normally distributed and the mean of X is 2 and standard deviation is 4. Find out the probability of the following :

(i) $X \geq 20$ (ii) $0 \leq X \leq 12$.

b) Calculate the coefficient of correlation for the following height (in inches) of fathers (X) and their sons (Y) :

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

~~19~~ 24

SECTION-C

15. The diameter of an electric cable, say X , is assumed to be a continuous random variable with probability density function $f(x) = 6x(1-x)$, $0 \leq x \leq 1$,
- i) Check that above is p.d.f., (ii) Determine a number b such that $P\{X < b\} = P\{X > b\}$.

16. Fit a parabola of second degree to the data :

X	0	1	2	3	4
Y	1	1.8	1.3	2.5	6.3

17. a) If 60 new entrants in a given university are found to have a mean height of 68.60 inches, and 50 seniors a mean height of 69.51 inches, is the evidence, conclusive that the mean height of the seniors is greater than that of the new entrants? Assume the standard deviation of height to be 2.48 inches.
- b) A dice is thrown 9000 times and a throw of 3 or 4 is observed 3240 times. Show that the dice cannot be regarded as an unbiased.
18. a) In an experiment on the immunization of goats from anthrax the following results were obtained. Derive your inference on the efficiency of the vaccine.

	Died of anthrax	Survived	Total
Vaccinated	2	10	12
Not vaccinated	6	6	12

(Take $\chi^2_{0.05}$ for 1 degree of freedom = 3.841)

- b) The means of two single large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can be samples be regarded as drawn from the same population of standard deviation 2.5 inches? (Test at 5% level of significance).

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Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (Mechanical Engg) (2018 & onwards) (Sem.-2)

MATHEMATICS-II

Subject Code : BTAM-203-18

M.Code : 76256

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer briefly :

1. Solve $y (\log y) dx + (x - \log y) dy = 0$.
2. Solve $p = \log (px - y)$.
3. Find the particular integral of $(D^2 - 2D + 4)y = e^x \cos x$.
4. Solve $(D^2 + 1)^3 = 0$.
5. What is the necessary and sufficient condition for a differential equation to be exact?
6. Define analytic function.
7. Evaluate $\oint_C (x^2 - y^2 + 2ixy) dz$ where C is the contour $|z| = 1$.
8. State maximum modulus theorem.
9. Find all zeros of $\sin z$.
10. What is the principal value of i^i ?

54

SECTION-B

11. Solve :

a) $x \frac{dy}{dx} + y = x^3 y^6$.

b) Solve $(xy^3 + y) dx + 2(x^2y^2 + x + y^4) dy = 0$.

12. Solve $y = 2px + y^2p^3$

13. a) Using method of variation of parameters, solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$.

b) Solve $y'' - 2y' + 5y = 0$ if $y(0) = -3, y'(0) = 1$.

14. Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + y = \log x \frac{\sin(\log x) + 1}{x}$.

SECTION-C

15. Show that the function $u = e^{-2xy} \sin(x^2 - y^2)$ is harmonic. Find conjugate function v and express $u + iv$ as an analytic function of z .

16. Derive Cauchy Riemann equations for analytic functions.

17. a) Evaluate $\int_{1-i}^{2+3i} (z^2 + z) dz$ along the line joining the points $(1, -1)$ and $(2, 3)$.

b) By integrating around a unit circle evaluate $\int_0^{2\pi} \frac{\cos 3\theta}{5 - 4 \cos \theta} d\theta$.

18. Evaluate $\frac{1}{z^2 - 3z + 2}$ in the region.

a) $|z| < 1$

b) $1 < |z| < 2$

c) $|z| > 2$

d) $0 < |z - 1| < 1$

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Roll No.

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (Electrical Engg./ECE) (2018 & Onwards) (Sem.-2)

MATHEMATICS-II

Subject Code : BTAM-202-18

M.Code : 76255

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

Answer briefly :

- 1) Is this differential equation $x^2 \left(\frac{d^2 y}{dx^2} \right)^3 + y \left(\frac{dy}{dx} \right)^4 + y^4 = 0$ linear?
- 2) Is this differential equation $(e^y + 1) \cos x dx + e^y \sin x dy = 0$ exact?
- 3) Write the solution of the Clairaut's equation $y = px + \cos^{-1}(p + 1)$.
- 4) Find complete solution of $\frac{\partial^2 z}{\partial x^2} - 4 \frac{\partial^2 z}{\partial x \partial y} + 4 \frac{\partial^2 z}{\partial y^2} = 0$.
- 5) Find particular integral of $\frac{\partial^2 z}{\partial x^2} - 7 \frac{\partial^2 z}{\partial x \partial y} + 12 \frac{\partial^2 z}{\partial y^2} = e^{x-y}$.
- 6) Give geometric interpretation of Newton Raphson method.
- 7) Give the Gauss's forward interpolation formula.
- 8) Write the formula for Simpson's $\frac{3}{8}$ rule.
- 9) Give the Adam's predictor corrector formula.
- 10) Write the one dimensional heat equation.

SECTION-B

11) Solve :

a) $\frac{dy}{dx} = \frac{2xy \cos x^2 - 2xy + 1}{x^2 - \sin x^2 - 3}$.

b) $\tan y \frac{dy}{dx} + \tan x = \cos y \cos^2 x$.

12) a) Solve $(x^2 D^2 - 2xD - 4)y = x^4$.

b) Solve using method of variation of parameters $\frac{d^2 y}{dx^2} - 6 \frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$.

13) Solve a) $yzp + zxq = xy$.

b) $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} - 6 \frac{\partial^2 z}{\partial y^2} = \cos(3x + y)$.

14) a) Solve the PDE $(D + D' - 1)(D + 2D' - 3)z = 4 + 3x + 6y$.

b) Using method of separation of variables, solve $3 \frac{\partial u}{\partial x} + 2 \frac{\partial u}{\partial y} = 0$ with $u(x, 0) = 4e^{-x}$.

SECTION-C

15) a) Find a root of $\cos x = xe^x$ using regula falsi method correct upto three decimal places.

b) Using interpolation, find missing values in the following table :

x	45	50	55	60	65
y	3.0	-	2.0	-	-2.4

27

16) a) Estimate $f(38)$, using Gauss backward difference formula :

x	20	25	30	35	40	45
$f(x)$	354	332	291	260	231	204

b) Estimate $\int_0^2 e^x dx$, using Trapezoidal rule by taking 10 intervals.

17) a) Use Taylor's series method to find the value of y at $x = 0.2$ upto 3 decimals, where $y(0) = 0$, $\frac{dy}{dx} = 1 - 2xy$.

b) Use Runge-Kutta method of order 4 to find the value of y at $x = 0.1$ upto 3 decimals, where $y(0) = 1$, $\frac{dy}{dx} = x + y$.

18) Using Crank-Nicholson method, solve the PDE $2\frac{\partial^2 f}{\partial x^2} = \frac{\partial f}{\partial t}$; $0 < t < 1.5$, $0 < x < 4$ subject to conditions $f(x, 0) = 50(4 - x)$, $f(0, t) = 0$, $f(4, t) = 0$.

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