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VTU Question Papers

BE-I & II sem(Physics & Chemistry Cycle)

Feb/Mar-2022

2018 & 2021 Scheme

Maharaja Institute of Technology Thandavapura

Just of NH-766,Mysore-ooty highway,Thandavapura(Vill & Post),Nanjangud Taluk,Mysore District-571302.

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First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   Derive an expression for single electrode potential.   **(07 Marks)**
    b.   What are concentration cell? A concentration cell was constructed by immersing two copper rods in $CuSO_4$ solution of concentration 0.02 M and 0.3 M respectively. Write the cell representation, cell reaction and calculate the emf of the cell at 25°C.   **(07 Marks)**
    c.   Explain the construction and working of Li - ion battery.   **(06 Marks)**

OR

2   a.   With a neat sketch explain the construction and working of calomel electrode. Write its advantages and application.   **(07 Marks)**
    b.   Explain the construction and working of Ni-MH battery. Write any two applications.   **(07 Marks)**
    c.   What are ion selective electrodes? Explain the construction and working of glass electrode. **(06 Marks)**

Module-2

3   a.   What is corrosion? Explain electrochemical theory of corrosion.   **(07 Marks)**
    b.   Explain Bimetallic and Pitting corrosion.   **(07 Marks)**
    c.   What is Electroless plating? Explain Electroless plating of Nickel.   **(06 Marks)**

OR

4   a.   Explain Polarization and Decomposition potential.   **(07 Marks)**
    b.   What is electroplating? Explain electroplating of Hard and Decorative Chromium.   **(07 Marks)**
    c.   What is Galvanization? Explain galvanization process of Zn.   **(06 Marks)**

Module-3

5   a.   Define calorific value. Explain the determination of calorific value of a solid fuel by Bomb calorimeter.   **(07 Marks)**
    b.   On burning 0.87 g of coal sample in a bomb calorimeter the temperature of water rise to 4.8°C. The mass of water in the calorimeter and water equivalent of calorimeter is 3800 g and 430 g and % of H_2 in the coal sample is 4.7, calculate GCV and NCV. (Given: Specific heat of water 4.18 kJ/kg/°C, latent heat of steam 2454 kJ/kg).   **(07 Marks)**
    c.   What is PV cell? Explain the construction and working of PV cell.   **(06 Marks)**

OR

6   a.   What are fuel cells? Explain the construction and working of $MeOH/O_2$ fuel cell.   **(07 Marks)**
    b.   What is meant by knocking? Explain the mechanism of knocking and write its ill effects. **(07 Marks)**
    c.   Write a note on Bio-Diesel.   **(06 Marks)**

Module-4

7 a. What are the sources of ozone depletion? What are its effects, how it is controlled?**(07 Marks)**

b. Mention the sources of solid waste and explain any two methods of disposal solid waste.

(07 Marks)

c. What is boiler feed water? Explain the mechanism of formation of sales and sludges. What are its disadvantages? **(06 Marks)**

OR

8 a. Define COD? Explain the experimental determination of COD. **(07 Marks)**

b. In a COD test 28.9 cm^3 and 13.3 cm^3 of 0.05N FAS solution was required for blank and sample titration respectively. The volume of the test sample used was 25 cm^3. Calculate the COD sample. **(07 Marks)**

c. Explain the sewage treatment by activated sludge process. **(06 Marks)**

Module-5

9 a. Explain the theory and instrumentation of Potentiometry. **(07 Marks)**

b. Explain the theory and instrumentation of Conductometry and plot graph for Strong acid vs Strong base → Weak acid vs Strong base. **(07 Marks)**

c. Explain the synthesis of nano materials by sol-gel process. **(06 Marks)**

OR

10 a. Write the synthesis of nano materials by chemical vapour deposition technique. **(07 Marks)**

b. Write a note on CNT and Fullerenes. **(07 Marks)**

c. Explain the theory and instrumentation of calorimetry by taking Cu as an example.**(06 Marks)**

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18CIV14/24

First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
Elements of Civil Engineering and Mechanics

Time: 3 hrs.   Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume any missing data suitably.

Module-1

1 a. Briefly tell about any two fields of Civil Engineering. **(04 Marks)**
   b. List the role of Civil Engineering in the infrastructural development of a country. **(06 Marks)**
   c. Four coplanar forces are acting at the point are shown in Fig.Q.1(c). One of the forces is unknown and its magnitude is P. The resultant has a magnitude of 500N and is acting along X – axis. What is the unknown force P and its inclination with X – axis. **(10 Marks)**
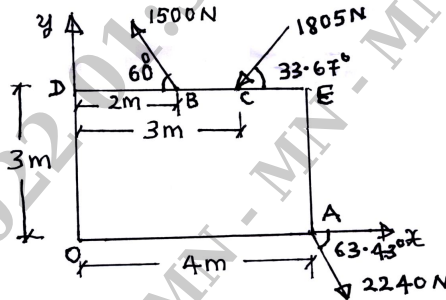
Fig.Q.1(c)

OR
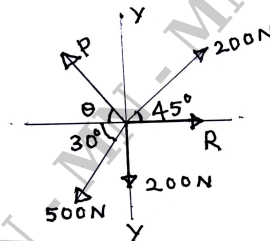
2 a. State and explain parallelogram law of forces. **(04 Marks)**
   b. State and prove Varignon's theorem of moments. **(06 Marks)**
   c. Fig.Q.2(c) shows coplanar system of forces acting on a flat plate. Determine:
   i)   The resultant
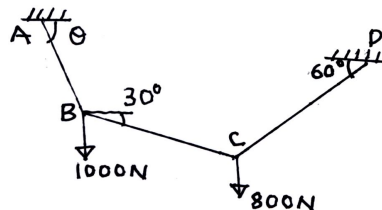   ii) X and Y intercepts with respect to point '0'. **(10 Marks)**

Fig.Q.2(c)

Module-2

3 a. Explain free body diagram with sketches. **(04 Marks)**
   b. State and prove Lami's theorem. **(06 Marks)**
   c. Compute the unknown angle and tension in the strings AB, BC and CD as shown in Fig.Q.3(c). **(10 Marks)**

Fig.Q.3(c)

OR

4 a. Prove that angle of friction is equal to angle to repose. **(06 Marks)**
   b. Define:
       i)   Limiting friction
       ii) Cone of friction. **(04 Marks)**
   c. Two blocks A and B of masses 30kg and 40kg respectively are connected by means of a bar placed on a inclined plane as shown in Fig.Q.4(c). If M = 0.25, find the value of θ required for the motion of block to impend. **(10 Marks)**
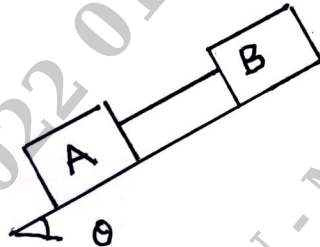
Fig.Q.4(c)

Module-3

5 a. Explain the different types of loading with sketches. **(06 Marks)**
   b. Briefly explain determinate and indeterminate beams. **(04 Marks)**
   c. A beam AB 1.7m long is loaded as shown in Fig.Q.5(c). Find the reactions at A and B. **(10 Marks)**
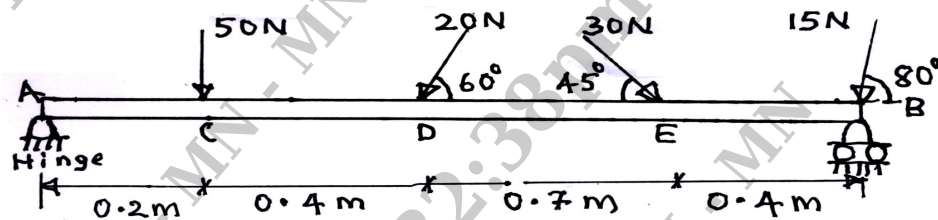
Fig.Q.5(c)

OR

6 a. What are the steps to be followed in the analysis of statically determinate trusses by the method of joints? **(06 Marks)**
   b. Analyze the truss shown in Fig.Q.6(b) by the method of joints. Tabulate the results and indicate the nature of forces in the truss. **(14 Marks)**
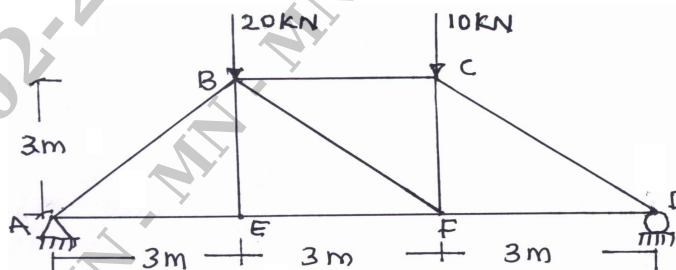
Fig.Q.6(b)

Module-4

7 a. State and prove parallel axis theorem. **(08 Marks)**

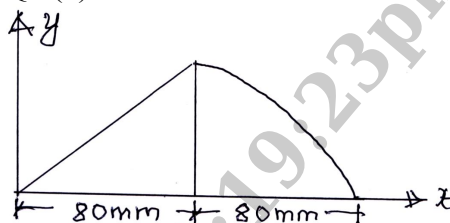b. Find the centroid for the Fig.Q.7(b) shown below:

Fig.Q.7(b)

(12 Marks)

OR

8 a. Find the centroid of a triangle of base 'b' and height 'h' from first principle. **(08 Marks)**

b. Determinate the moment of inertia of Fig.Q.8(b) about centroidal X axis and Y axis.
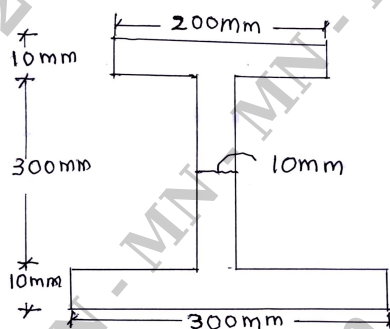
(12 Marks)

Fig.Q.8(b)

Module-5

9 a. Define:
   i) Trajectory
   ii) Time of flight
   iii) Superelevation
   iv) Curve linear motion
   v) Rectilinear motion. **(10 Marks)**

b. A tower in 90m in height. A particle is dropped from the top of tower and at the same time another particle is projected upward from the foot of tower. Both the particle meet at a height of 30m with respect foot of the tower. Find the velocity with which second particle is projected upward. **(10 Marks)**

OR

10 a. State and explain D'Alembert's principle. **(08 Marks)**

b. Two weights 800N and 200N are connected by thread and they move along a rough horizontal plane under the action of force of 400N applied to the 800N weight as shown in Fig.Q.10(b). Using D'Alembert's principle, find the acceleration of weights and tension in thread. Take coefficient of friction = 0.3. **(12 Marks)**
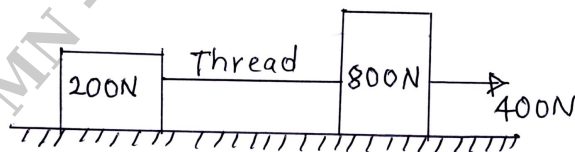

Fig.Q.10(b)

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First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
C Programming for Problem Solving

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Write an algorithm and draw flow chart, which reads 3 sides of a triangle and prints whether it is equilateral, isosceles and scalene. **(08 Marks)**
   b. Write basic structure of C program and explain its different sections. Also, give an example. **(08 Marks)**
   c. Identify the following variable names. State whether variable is valid or invalid. If invalid give reasons i) INT ii) for   iii) 1area   iv) STATIC. **(04 Marks)**

OR

2 a. List and mention function of any five flow chart symbols. **(05 Marks)**
   b. Define C-token. List and explain different C-tokens. **(10 Marks)**
   c. Write a C program to swap contents of two variables. Print contents of variable before swap and after swap. **(05 Marks)**

Module-2

3 a. Distinguish between the following functions:
      i)   scanf( ) and gets( )
      ii)   scanf( ) and printf( )
      iii) putchar( ) and printf( ) **(06 Marks)**
   b. Write a C program to generate and print first 'N' Fibonacci numbers using looping constructs. **(08 Marks)**
   c. Write the syntax of Nested if..else statement and explain its working. **(06 Marks)**

OR

4 a. Write a C program to print the string "PROGRAM" in following pattern using formatted output statement

```
            P
          P R
        P R O
      P R O G
    P R O G R
  P R O G R A
P R O G R A M
```
(08 Marks)

   b. Distinguish between the following:
      i)   while loop and do..while loop
      ii)   break and continue. **(06 Marks)**
   c. Write the syntax of else..if ladder and explain its working. **(06 Marks)**

Module-3

5   a.   Define an array. Write the syntax of declaration and initialization of – one-dimensional array and two-dimensional array with example for each. **(10 Marks)**
    b.   Write a C program to search a key element in the given sorted array of integer numbers using binary search technique. **(06 Marks)**
    c.   Write a C program to copy one string to another without using strcpy( ). **(04 Marks)**

OR

6   a.   Write a C program to read a square matrix A (m × n) and find the trace of the matrix. **(08 Marks)**
    b.   List advantages and disadvantages of array. **(06 Marks)**
    c.   Write the syntax and give one example for built-in string functions listed below:
         i) strncmp( )   ii) strncpy( )   iii) strrev( )   iv) strncat( )   v) strcat( )   vi) strlen( ) **(06 Marks)**

Module-4

7   a.   List and explain two techniques for passing parameters from one function to another by taking an example of C program. **(10 Marks)**
    b.   Differentiate between recursion and iteration. **(06 Marks)**
    c.   Write a C program to find factorial of a given number using recursion. **(04 Marks)**

OR

8   a.   Write a C program to compute nc_r for the given values of n and r using recursion. **(10 Marks)**
    b.   Distinguish between built-in functions and user defined functions. **(04 Marks)**
    c.   List any six benefits of functions. **(06 Marks)**

Module-5

9   a.   Write a note on the following by giving segment of C program:
         i)   Array of structure
         ii)   Structure within a structure. **(08 Marks)**
    b.   Define pointer. Mention any two differences between a pointer variable and a normal variable. **(04 Marks)**
    c.   What is pre-processor directives? Mention significance of following C-pre-processors:
         i) #ifdef   ii) #pragma   iii) #include   iv) #undef   v) #define   vi) #error **(08 Marks)**

OR

10 a.   Create a structure student having members name and USN. Write a C program which reads details of 5 students and print the same. **(10 Marks)**
    b.   Define macro. Using macros, write a C program to find area of circle. **(06 Marks)**
    c.   Define pointer. Write the syntax and give an example of declaring and assigning a value to pointer. **(04 Marks)**

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CBCS SCHEME

First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Basic Electrical Engineering

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State Kirchoff's law for DC circuits. Illustrate with an example. **(08 Marks)**

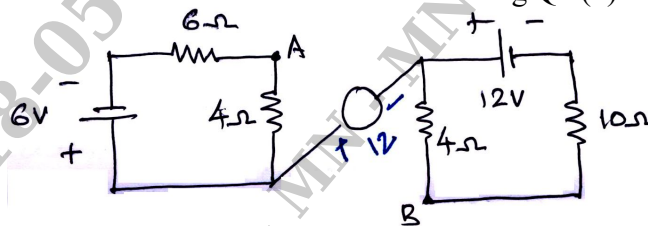   b. What is the voltage across A and B in the circuit shown in Fig.Q.1(b). **(06 Marks)**

Fig.Q.1(b)

    c. Define the following terms:
   i)   Average value
   ii)   RMS value
   iii)   Form factor. **(06 Marks)**

OR

2 a. Prove that the maximum power will be transferred to the load when load resistance is equal to the source resistance. **(06 Marks)**

    b. A pure inductor excited by sinusoidal varying AC voltage, show that the average power consumed by inductor is zero. **(08 Marks)**

    c. A 318μF capacitor is connected across a 230V, 50Hz system. Determine: i) Capacitive reactance   ii) RMS value of current   iii) Extrusions for instantaneous voltage and current v(t) and i(t). **(06 Marks)**

Module-2

3 a. Define: i) Real power   ii) Reactive power   iii) Power factor. **(06 Marks)**

    b. A series circuit with R = 10Ω, L = 50mH and C = 100μF is supplied with 200V, 50Hz. Find:
   i) The impedance   ii) Current   iii) Power   iv) Power factor. **(08 Marks)**

    c. Deduce the relationship between the phase and the line voltages of a three phase star connected system. **(06 Marks)**

OR

4 a. Deduce the relationship between the phase and the line current of a three phase delta connected system. **(06 Marks)**

    b. A balanced star connected load of (8 + j6)Ω per phase is connected to a three phase 230V supply. Find the current, power factor, power, reactive volt ampere and total voltampere. **(05 Marks)**

    c. Three phase power consumed by the balanced load is given by P = $\sqrt{3}$ V_L I_L cosϕ watts, then show that two wattmeter is sufficient to measure three phase power P. **(09 Marks)**

1 of 2

Module-3

5 a. With neat sketch, explain the different parts of a DC generators. **(06 Marks)**

b. Give the classification of DC generator. Obtain the expression for EMf equation of a DC generator. **(08 Marks)**

c. Give broad classification of transformers. Explain the construction of transformer.
(06 Marks)

OR

6 a. Derive the expression for emf induced in the primary or secondary side of a transformer.
(06 Marks)

b. Derive an expression for the torque developed by a DC motor. **(06 Marks)**

c. A 250KVA, 11000/415V, 50Hz single phase transformer has 80 turns on the secondary, calculate:
   i) Rated primary and secondary currents.
   ii) Number of primary turns.
   iii) Maximum value of core flux.
   iv) Voltage induced per turn. **(08 Marks)**

Module-4

7 a. Explain the concept of rotating magnetic field in case of stator field a 3-phase induction machine with a neat diagram. **(08 Marks)**

b. Define slip of an induction motor and derive expression for the frequency of rotor currents.
(06 Marks)

c. Describe the main parts of synchronous generator with neat sketches. **(06 Marks)**

OR

8 a. A 3 phase induction motor with 4 poles is supplied from an alternator having 6 poles and running at 1000rpm. Calculate synchronous speed of the induction motor, its speed when slip is 0.04 and frequency of the rotor emf when speed is 600rpm. **(08 Marks)**

b. Derive the emf equation of a synchronous generator. **(06 Marks)**

c. A 24 pole turbo alternator has a star connected armature winding with 144 slots and 10 conductors per slot. It is driven by a low speed Kaplan turbine at a speed of 250rpm. The winding has full pitched coils with a distribution factor of 0.966. The flux per pole is 67.3mWb. Determine: i) Frequency and magnitude of the line voltage   ii) Output KVA of the machine if the total current in each phase is 50A. **(06 Marks)**

Module-5

9 a. What is electric power supply system? Draw a single line diagram of a typical a.c supply scheme. **(06 Marks)**

b. What is the necessity of earthing? Explain plate earthing. **(08 Marks)**

c. Explain the working principle of fuse and MCB. **(06 Marks)**

OR

10 a. Explain components of low voltage distribution system with neat sketches. **(06 Marks)**

b. A consumer uses a 10kW geezer, a 6kW electric furnace and five 100W bulbs for 8 hours. How many units of electrical energy have been used? Define an electrical energy unit.
(06 Marks)

c. What do you mean by electric shock? Write a short note on precautions against an electric shock. **(08 Marks)**

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First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
Basic Electronics

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. Explain the operation of PN junction diode under forward and reverse bias conditions.
(06 Marks)

  b. A full wave bridge rectifier with an input of 100V (rms) feeds a load of 1KΩ, $V_T = 0.7V$.
    i)   If the diodes employed are silicon, what is the DC voltage across the load?
    ii) Determine the PIV rating of each diode
    iii) Determine the maximum current that each diode conducts and the diode power rating.
(06 Marks)

  c. Write a short note on :
    i)   Light emitting diode
    ii) Photodiode
    iii) Photo coupler.
(08 Marks)

OR

2   a. What is Zener diode? With a neat circuit diagram, explain the operation of a voltage regulator.
(08 Marks)

  b. A silicon diode has $I_S = 10nA$ at 25°C. Calculate I_D for a forward bias of 0.6V.
(04 Marks)

  c. Define rectifier. Sketch a half wave rectifier with waveforms derive the following :
    i)   Average voltage
    ii) Average current
    iii) Efficiency
    iv) Ripple factor.
(08 Marks)

Module-2

3   a. Explain the construction and operation of N-channel JFET
(06 Marks)
  b. With a neat diagram, explain the operation of CMOS inverter.
(08 Marks)
  c. With a neat diagram, explain the VI characteristics of SCR.
(06 Marks)

OR

4   a. Explain the characteristics of n-channel JFET.
(06 Marks)
  b. With a neat diagram, explain the characteristics of a enhancement type MOSFET (N-channel).
(08 Marks)
  c. With neat diagram, explain the two transistor model of an SCR.
(06 Marks)

Module-3

5   a. For an op-amp :
    i)   List the characteristics of an ideal op-amp
    ii) Draw the three input summing circuit (inverting amplifier) and drive the expression for its output voltage.
(08 Marks)
  b. Define the terms with respect to op-amp
    i) Slew rate   ii) CMRR   iii) Common mode gain Acm or Ac of op-amp.
(06 Marks)
  c. Design an adder circuit using an op-amp to obtain the output voltage of $-(2V_1 + 3V_2 + 5V_3)$.
(06 Marks)

OR

6 a. Draw the circuit of non-inverting op-amp. Derive the expression for its voltage gain.

(08 Marks)

   b. With a neat circuit diagrams, explain how an op-amp can be used as a :
      i) differentiator ii) an integrator.

(06 Marks)

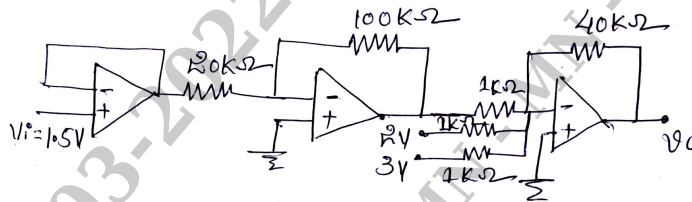   c. Find the output V_0 for the following op-amp circuit.

Fig.Q6(c)

(06 Marks)

Module-4

7 a. What is an amplifier? Explain the operation of transistor amplifier circuit. **(08 Marks)**
   b. Define feedback amplifier? With a necessary diagram and equation explain different types of feedback. **(12 Marks)**

OR

8 a. Briefly explain how a transistor is used as an electronic switch. **(06 Marks)**
   b. Explain how 555 timer can be used as an oscillator. **(06 Marks)**
   c. Define an oscillator? Derive the equation for Wein bridge oscillator. **(08 Marks)**

Module-5

9 a. Convert the following :

   i) $(725.25)_{10} = (?)_2 = (?)_{16}$

   ii) $(111100111110001)_2 = (?)_{10} = (?)_{16}$. **(08 Marks)**

   b. Simplify the following :

   i) $AB + \overline{A}C + A\overline{B}C(AB + C)$

   ii) $(A + \overline{B})(CD + E)$. **(06 Marks)**

   c. Realize a full adder using 2-half adders. **(06 Marks)**

OR

10 a. What is multiplex? Explain the working of 4 : 1MUX. **(06 Marks)**
    b. With the help of a logic diagram and truth table, explain the working of a clocked SR flip-flop. **(06 Marks)**
    c. What is a shift register? Explain the working a 4-bit SISO shift register. **(08 Marks)**

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First Semester B.E. Degree Examination, Feb./Mar. 2022
Calculus and Linear Algebra

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Show that the curves $r = ae^{\theta}$ and $re^{\theta} = b$ cut orthogonally. **(06 Marks)**

   b. For the curve, $y = \dfrac{ax}{a+x}$ show that $\left(\dfrac{2\rho}{a}\right)^{2/3} = \left(\dfrac{x}{y}\right)^{2} + \left(\dfrac{y}{x}\right)^{2}$ **(06 Marks)**

   c. Show evolute of the Ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ is $(xa)^{2/3} + (yb)^{2/3} = (a^2 - b^2)^{2/3}$ **(08 Marks)**

OR

2 a. With usual notations prove that $\tan\phi = r\dfrac{d\theta}{dr}$ **(06 Marks)**

   b. Find the radius of curvature of the curve $r^2 = a^2 \sec 2\theta$. **(06 Marks)**

   c. Find the angle between the curves $r = a \log \theta$, $r = \dfrac{a}{\log\theta}$. **(08 Marks)**

Module-2

3 a. Obtain Maclaurin's series expansion of $\log(1 + \cos x)$ upto the term containing x^4. **(06 Marks)**

   b. Evaluate $\underset{x \to 0}{\text{Lt}}\left(\dfrac{a^x + b^x + c^x + d^x}{4}\right)^{1/x}$ **(07 Marks)**

   c. Find the extreme values of the function $f(x, y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$. **(07 Marks)**

OR

4 a. If $u = x^2 + y^2 + z^2$, $x = e^{2t}$, $y = e^{2t}\cos 3t$, $z = e^{2t}\sin 3t$ then find $\dfrac{du}{dt}$. **(06 Marks)**

   b. The temperature T at any point (x, y, z) in space is $T = 400\, xyz^2$. Find the highest temperature at the surface of the unit sphere $x^2 + y^2 + z^2 = 1$. **(07 Marks)**

   c. If $u = x^2 - 2y^2$, $v = 2x^2 - y^2$ where $x = r\cos\theta$, $y = r\sin\theta$ then show that
   $$\dfrac{\partial(u, v)}{\partial(r, \theta)} = 6r^3 \sin 2\theta.$$ **(07 Marks)**

Module-3

5 a. Evaluate $\displaystyle\int_0^a\int_y^a \dfrac{x}{x^2 + y^2}\, dx\, dy$ by changing the order of integration. **(06 Marks)**

   b. Find by double integration, volume of the ellipsoid $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} + \dfrac{z^2}{c^2} = 1$ **(07 Marks)**

   c. With usual notations, show that the relation between Beta function and Gamma function is
   $$\beta(m, n) = \dfrac{\gamma(m).\gamma(n)}{\gamma(m+n)}$$ **(07 Marks)**

OR

6 a. Evaluate $\displaystyle\int_0^4 \int_0^{2\sqrt{z}} \int_0^{\sqrt{4z-x^2}} dy\,dx\,dz$ **(06 Marks)**

b. Evaluate $\displaystyle\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}dx\,dy$ by changing into polar coordinates. **(07 Marks)**

c. Prove that $\displaystyle\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta\cdot\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}}=\pi$ **(07 Marks)**

Module-4

7 a. Solve $\dfrac{dy}{dt}+y\tan x = y^3\sec x$ **(06 Marks)**

b. Show that the family curves $y^2 = 4a(x + a)$ is self orthogonal. **(07 Marks)**

c. Solve $x^2p^2 + xyp - 6y^2 = 0$ by solving for p. **(07 Marks)**

OR

8 a. Solve $(x^2 + y^3 + 6x)dx + xy^2\,dy = 0$. **(06 Marks)**

b. If the air is maintained at 30°C and the temperature of the body cools from 80°C to 60°C in 12 minutes, find the temperature of the body after 24 minutes. **(07 Marks)**

c. Solve $y^2(y - xp) = x^4p^2$ using substitution $X = 1/x$ and $Y = 1/y$. **(07 Marks)**

Module-5

9 a. Find the rank of the matrix
$$\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$$ by elementary transformations. **(06 Marks)**

b. Apply Gauss Jordan method to solve the system of equations
$2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$. **(07 Marks)**

c. Find the largest eigen value and the corresponding eigen vector of the matrix
$$A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$$ by Rayleigh's power method. Perform four iterations. Take initial vector as $[1\ \ 0\ \ 0]^T$. **(07 Marks)**

OR

10 a. Investigate the values of λ and μ so that the equations
$2x + 3y + 5z = 9$, $7x + 3y - 2z = 8$, $2x + 3y + \lambda z = \mu$ have
(i) a unique solution, (ii) infinitely many solutions   (iii) no solution. **(06 Marks)**

b. Use the Gauss-Seidel iterative method to solve the system of equations $5x + 2y + z = 12$, $x + 4y + 2z = 15$, $x + 2y + 5z = 20$.   Carryout four iterations, taking the initial approximation to the solution as $(1, 0, 3)$. **(07 Marks)**

c. Diagonalize the matrix $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$. Hence determine A^4. **(07 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐ **18MAT21**

Second Semester B.E. Degree Examination, Feb./Mar.2022
Advanced Calculus and Numerical Methods

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$. **(06 Marks)**

b. Find the divergence and curl of the vector $\vec{F}$ if $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. **(07 Marks)**

c. Show that $\vec{F} = (y + z)i + (z + x)j + (x + y)k$ is irrotational and also find a scalar function ϕ such that $\vec{F} = \nabla\phi$. **(07 Marks)**

OR

2 a. Verify Green's theorem for $\int_C (xy + y^2)dx + x^2 dy$, where C is the bounded by $y = x$ and $y = x^2$. **(06 Marks)**

b. Using Stoke's theorem, evaluate $\int_C xydx + xy^2 dy$, where C is the square in the x-y plane with vertices $(1, 0)(-1, 0)(0, 1)(0, -1)$. **(07 Marks)**

c. Using Gauss divergence theorem, evaluate $\iint_C \vec{F}\vec{n}\rceil\,ds$ over the entire surface of the region above xy-plane bounded by the cone $z^2 = x^2 + y^2$ and the plane $z = 4$, where $\vec{F} = 4xz\,\vec{i} + xyz^2\,\vec{j} + 3z\,\vec{k}$. **(07 Marks)**

Module-2

3 a. Solve $(D^2 - 4D + 13)y = \cos 2x$, where $D = \dfrac{d}{dx}$. **(06 Marks)**

b. Solve $(D^2 - 2D + 1)y = \dfrac{e^x}{x}$, by the method of variation of parameter, where $D = \dfrac{d}{dx}$. **(07 Marks)**

c. Solve $x^3 \dfrac{d^3 y}{dx^3} + 2x^2 \dfrac{d^2 y}{dx^2} + 2y = 10\left(x + \dfrac{1}{x}\right)$. **(07 Marks)**

OR

4 a. Solve $(D - 2)^2 y = 8(e^{2x} + \sin 2x)$, where $D = \dfrac{d}{dx}$. **(06 Marks)**

b. Solve $(1 + x)^2 \dfrac{d^2 y}{dx^2} + (1 + x)\dfrac{dy}{dx} + y = \sin 2[\log(1 + x)]$. **(07 Marks)**

c. The differential equation of the displacement x(t) of a spring fixed at the upper end and a weight at its lower end is given by $10\dfrac{d^2x}{dt^2}+\dfrac{dx}{dt}+200x=0$. The weight is pulled down 0.25 cm, below the equilibrium position and then released. Find the expression for the displacement of the weight from its equilibrium position at any time t during its first upward motion. **(07 Marks)**

Module-3

5 a. Form the partial differential equation by eliminating the arbitrary constants form, $(x-a)^2+(y-b)^2+z^2=C^2$. **(06 Marks)**

b. Solve $\dfrac{\partial^2 z}{\partial x\partial y}=\sin x\sin y$ for which $\dfrac{\partial z}{\partial y}=-2\sin y$ when x = 0 and z = 0 if y is an odd multiple of $\dfrac{\pi}{2}$. **(07 Marks)**

c. Derive one-dimensional heat equation in the standard form. **(07 Marks)**

OR

6 a. Form the partial differential equation by eliminating the arbitrary function from $z=f(x+ct)+g(x-ct)$ **(06 Marks)**

b. Solve $(y-z)p+(z-x)q=(x-y)$. **(07 Marks)**

c. Solve one dimensional wave equation, using the method of separation of variables. **(07 Marks)**

Module-4

7 a. Test for the convergence or divergence of the series $\displaystyle\sum_{n=1}^{\infty}\dfrac{n!}{\left(n^n\right)^2}$. **(06 Marks)**

b. Solve Bessel's differential equation leading to $J_n(x)$. **(07 Marks)**

c. Express $x^4-2x^3+3x^2-4x+5$ interms of legendre polynomial. **(07 Marks)**

OR

8 a. Discuss the nature of the series, $\dfrac{1}{2}+\left(\dfrac{2}{3}\right)x+\left(\dfrac{3}{4}\right)^2 x^2+\left(\dfrac{4}{5}\right)^3 x^3+........$ **(06 Marks)**

b. With usual notation, show that

(i) $J_{1/2}(x)=\sqrt{\dfrac{2}{\pi x}}\sin x$

(ii) $J_{-1/2}(x)=\sqrt{\dfrac{2}{\pi x}}\cos x$ **(07 Marks)**

c. Use Rodrigues formula to show that $P_4(\cos\theta)=\dfrac{1}{64}\left[35\cos 4\theta+20\cos 2\theta+9\right]$. **(07 Marks)**

Module-5

9 a. Find a real root of the equation $\cos x-3x+1=0$, correct to 3 decimal places using regula falsi method. **(06 Marks)**

b. Use an appropriate interpolation formula to compute $f(42)$ using the following data:

x	40	50	60	70	80	90
f(x)	184	204	226	250	276	304

(07 Marks)

c. Evaluate $\int_{4}^{5.2} \log x \, dx$ by using Weddle's rule, divided into six equal parts. **(07 Marks)**

OR

10 a. Find a real root of the equation, $x \sin x + \cos x = 0$ near $x = \pi$, correct to four decimal places. Using Newton-Raphson method. **(06 Marks)**

b. Find f(9) from the day by Newton's divided difference formula. **(07 Marks)**

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

c. By using Simpson's $\frac{1}{3}^{rd}$ rule $\int_{0}^{1} \frac{dx}{1+x^2}$ dividing interval $(0, 1)$ into six equal parts and hence find approximate value of π. **(07 Marks)**

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First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
Elements of Mechanical Engineering

Time: 3 hrs.   Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume missing data, if any.
3. Use of steam table is permitted.

Module-1

1 a. Explain in brief three primary processes of solar energy conversion into other forms of energy. **(10 Marks)**

  b. Write a note on global warming and ozone depletion. **(10 Marks)**

OR

2 a. State and explain zeroth law, first law and second law of thermodynamics. **(10 Marks)**

  b. Find the specific volume and enthalpy of 1 kg of steam at 0.8 MPa when:
  (i) The steam is 10% wet.
  (ii) The steam is heated to a temperature of 300°C.
  Assume C_{Ps} value as 2.25 kJ/kg. **(10 Marks)**

Module-2

3 a. What are the advantages and disadvantages of water tube boiler over fire tube boiler? **(06 Marks)**

  b. List the boiler mountings such as mountings for safety and operations. **(04 Marks)**

  c. With a neat sketch, explain the working of Pelton wheel. **(10 Marks)**

OR

4 a. Explain with neat sketch the working of centrifugal pump. **(10 Marks)**

  b. Classify turbines. Explain the working of FRANCIS turbine. **(10 Marks)**

Module-3

5 a. With the help of theoretical P-V diagram, explain OTTO four stroke cycle engine. **(10 Marks)**

  b. The following observations were obtained during a trial on a 4-stroke diesel engine:
  Cylinder dia = 250 mm
  Stroke of the piston = 400 mm
  Crankshaft speed = 250 rpm
  Brake load = 687 N
  Brake drum dia = 2m
  Diesel oil consumption = 0.1 m³/min
  Specific gravity of diesel = 0.78
  Calorific value of diesel = 43900 kJ/kg
  Find: (i) BP   (ii) IP   (iii) FP   (iv) η_{mech} (v) $\eta_{B.T}$ **(10 Marks)**

OR

6 a. Give the list of refrigerants with their applications. **(05 Marks)**

  b. Define the following:
  (i) Refrigerating effect   (ii) Ton of refrigeration   (iii) COP
  (iv) Relative COP   (v) Ice making capacity **(05 Marks)**

  c. Explain with neat sketch the working principle of vapour absorption refrigeration. **(10 Marks)**

Module-4

7 a. What is composite material? State advantages and applications of composite materials.
   (06 Marks)
   b. Write short notes on: (i) Shape memory materials (ii) Optical fibre glass **(04 Marks)**
   c. Derive an expression for the length of belt in crossed belt drive. **(10 Marks)**

OR

8 a. Classify metal joining processes. Explain different types of flames used in oxy-acetylene welding. **(10 Marks)**
   b. A simple gear train consists of four gears having 30, 40, 50, 60 teeth respectively. Determine the speed and direction of the last gear if the first gear makes 600 rpm in clockwise direction. **(10 Marks)**

Module-5

9 a. How do you specify a lathe? **(04 Marks)**
   b. Explain with a neat sketch taper turning by compound slide swiveling method. **(10 Marks)**
   c. Explain the following operations on milling machine with suitable sketches:
   (i) Plain milling   (ii) Straddle milling   (iii) Gang milling **(06 Marks)**

OR

10 a. Define robot. List the industrial applications of robot. **(05 Marks)**
   b. Explain the components of CNC with a block diagram. **(10 Marks)**
   c. Differentiate between open loop and closed loop systems. **(05 Marks)**

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18PHY12/22

First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
Engineering Physics

Time: 3 hrs.   Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Physical constants : Velocity of light, c = 3 × 10⁸ m/s

$$Planck's\ constant,\ h = 6.625 \times 10^{-34}\ JS$$
$$Boltzmann's\ constant,\ K = 1.38 \times 10^{-23}\ J/K$$
$$Avogadro's\ number,\ N_A = 6.02 \times 10^{26}/Kmole$$
$$Mass\ of\ electron,\ m_e = 9.1 \times 10^{-31}\ kg$$
$$Charge\ of\ electron,\ e = 1.602 \times 10^{-19}\ C$$
$$Relative\ Permittivity\ of\ vacuum,\ \epsilon_0 = 8.854 \times 10^{-12}\ Fa/m$$

Module-1

1   a. Define simple harmonic motion. Derive the equation for simple harmonic motion using Hooke's law. Mention any five characteristics of simple harmonic motion. **(10 Marks)**
    b. State the laws of conservation of mass, momentum and energy along with the equations. **(06 Marks)**
    c. A mass of 5 kg is suspended from the free end of a spring. When set for vertical oscillations, the system executes 100 oscillations in 40 seconds. Calculate the force constant of the spring. **(04 Marks)**

OR

2   a. What are forced vibrations? Obtain an expression for amplitude of a body undergoing forced vibration. **(10 Marks)**
    b. Distinguish between subsonic and supersonic waves. Mention any two applications of shock waves. **(06 Marks)**
    c. Calculate the resonance frequency of a spring of force constant 1974 N/m, carrying a mass of 2000 gm. **(04 Marks)**

Module-2

3   a. State and explain Hooke's law. Define Young's modulus, Bulk modulus, Rigidity modulus and derive the respective equations. **(08 Marks)**
    b. Derive the relation y, η and σ. **(08 Marks)**
    c. Calculate the torque required to twist a wire of length 1.5 m, radius 0.0425×10^{-2} m, through an angle $(\pi/45)$ radian, if the value of rigidity modulus of its material is 8.3×10^{10} N/m². **(04 Marks)**

OR

4   a. Define bending moment. Derive the expression for the bending moment of a beam in terms of moment of inertia. **(09 Marks)**
    b. Define the terms elasticity and plasticity. Explain the stress-strain curve. **(07 Marks)**
    c. A rod of cross section of area 1 cm × 1 cm in rigidly planted into the earth vertically. A string which can withstand a maximum tension of 2 kg is tied to the upper end of the rod and pulled horizontally. If the length of the rod from the ground level is 2 meters, calculate the distance through which its upper end is displaced just before the string snaps. (y for steel = 2×10^{11} N/m² and g = 9.8 m/s²) **(04 Marks)**

Module-3

5 a. Explain the concept of divergence of a vector and its physical significance. State and derive Gauss divergence theorem. **(10 Marks)**

b. Obtain an expression for numerical aperture in an optical fiber. **(06 Marks)**

c. Find the attenuation in an optical fiber of length 500 m when a light signal of power 100 mW emerges out of the fiber with a power 90 mW. **(04 Marks)**

OR

6 a. What is attenuation and attenuation coefficient? Explain different attenuation mechanisms. **(08 Marks)**

b. List the four Maxwell's equations for time-varying condition. Derive the wave equation for electromagnetic waves using Maxwell's equations. **(08 Marks)**

c. Find the divergence of the vector field $\vec{A}$ given by $\vec{A} = 6x^2\hat{a}_x + 3xy^2\hat{a}_y + xyz^3\hat{a}_z$ at a point P(1, 3, 6). **(04 Marks)**

Module-4

7 a. State and explain Heisenberg's uncertainty principle. Using this principle, prove that an electron does not exist inside the nucleus. **(08 Marks)**

b. Derive the expression for energy density of radiation in terms of Einstein's coefficients. **(08 Marks)**

c. A particle of mass 0.5 Mev/c^2 has kinetic energy 100 eV. Find its de-Broglie wavelength. **(04 Marks)**

OR

8 a. Find the expression for Eigen value and Eigen function for a particle in uninfinite potential well. **(10 Marks)**

b. What is a laser range finder? Describe how it is made use in defense. **(06 Marks)**

c. The average output power of a laser source emitting a laser beam of wavelength 6328 A° is 5 mW. Find the number of photons emitted per second by the laser. **(04 Marks)**

Module-5

9 a. Define Fermi factor. Discuss the dependence of Fermi factor on temperature and energy. **(08 Marks)**

b. What is internal field? Derive Clausius-Mossotti equation. **(08 Marks)**

c. The Hall coefficient of a material is -3.68×10^{-5} m^3/c. Identify the type of charge carriers and calculate the carrier concentration. **(04 Marks)**

OR

10 a. Derive the expression for electrical conductivity of a semiconductor. **(08 Marks)**

b. What are the main assumptions of quantum free electron theory and describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory. **(08 Marks)**

c. If a NaCl crystal is subjected to an electric field of 1000 V/m and the resulting polarization is 4.3×10^{-8} c/m^2, calculate the dielectric constant of NaCl. **(04 Marks)**

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First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
Basic Electrical Engineering

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. State and explain Kirchhaff's laws and ohm's law. **(06 Marks)**

   b. Find :
   i)   Voltage drop across 4 Ω
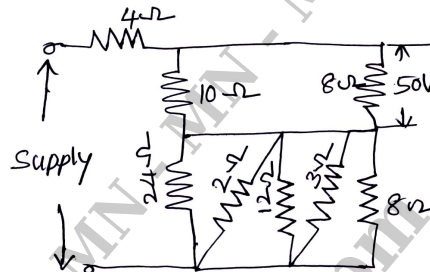   ii) Supply voltage for the networks shown in Fig.Q1(b).

Fig.Q1(b)   **(08 Marks)**

   c. Define the following :
   i) Average value of alternating current   ii) Form factor   iii) Peak factor. **(06 Marks)**

OR

2 a. Two resistance 20Ω and 40Ω are connected in parallel. A resistance of 10Ω is connected in series with the combination. A voltage of 200V is applied across the circuit. Find the current in each resistance and voltage across 10Ω. Find also the power consumed in all the resistors. **(08 Marks)**

   b. Derive the expression for RMS value average current of a sinusoidally varying quantity. **(08 Marks)**

   c. Two alternating currents in a parallel circuit are represented by $i_1 = 5\sin \omega t$ and $i_2 = 10 \sin(\omega t + 60°)$. Find the resultant current. **(04 Marks)**

Module-2

3 a. Show that a pure inductance does not consume any power draw the waveforms of voltage, current, power when an alternating voltage is applied to pure inductance. **(08 Marks)**

   b. A coil of resistance 10Ω and inductance 0.1H is connected in series with a 150μF capacitor across a 200V, 50Hz supply. Calculate :
   i)   Inductive reactance
   ii) Capacitive reactance
   iii) Impedance
   iv) Current
   v)   Power factor
   vi) Voltage across coil
   vii) Voltage across capacitor. **(08 Marks)**

   c. An inductive coil takes a current of 33.24a from 230V, 50Hz supply, if the resistance of coil is 6Ω. Calculate inductance of the coil and power taken by the coil. **(04 Marks)**

OR

4 a. In a three phase star connection, show that $V_L = \sqrt{3}V_{ph}$ also draw vector diagram of line voltage and phase voltage. **(07 Marks)**

   b. What are the advantages and three phase system over a single phase system? **(07 Marks)**

   c. A delta connected load consist of a resistance of 10Ω and capacitance of 100μF in each phase. A supply of 410V at 50Hz a applied to the load. Find line current, power consumed by the load and power factor. **(06 Marks)**

Module-3

5 a. Derive the EMF equation of a transformer. **(06 Marks)**

   b. A single phase transformer working at 0.8 power factor has an efficiency at 94% at both ¾ full load and pull load of 600KW. Find the efficiency at ½ full load unity power factor. **(08 Marks)**

   c. Primary winding of a transformer is connected to a 240V, 50Hz. The secondary winding has 1500 turns and the maximum value of core flux is 0.00207 ωb. Find secondary induced emf, number of turns in primary and cross sectional area of core. If max value of flux density is 0.465 Tesla. **(06 Marks)**

OR

6 a. Explain plate Earthing. **(06 Marks)**

   b. With circuit diagram and switching table, explain two-way control of lamp. **(08 Marks)**

   c. What are the precaution to be taken against electric shock? **(06 Marks)**

Module-4

7 a. Draw a neat sketch of DC machine and name the parts and briefly explain the function of each. **(10 Marks)**

   b. A 4-pole, 220V, Lap connected DC shunt motor has 36 slots, each slot containing 16 conductors, it draws a current of 40A from the supply. The field resistance and armature resistance are 110Ω and 0.1Ω respectively. The motor develops an output power of 6KW. Flux per pole is 40MWb. Calculate : i) speed ii) torque developed by the armature iii) shaft torque. **(10 Marks)**

OR

8 a. EMF generated in the armature of a shunt generator is 625V. When delivering its full current of 400A to an external circuit. The field current is 6A and armature resistance is 0.06Ω. What is the terminal voltage? **(06 Marks)**

   b. Sketch the various characteristic of DC motor (shunt). **(08 Marks)**

   c. What is the significance of back EMF in a DC motor? **(06 Marks)**

Module-5

9 a. Derive the EMF equation of an alternator. **(06 Marks)**

   b. 4-pole, 1500rpm, star connected alternator has 9 slot/pole, and 8 conductor per slot. Find the flux per pole to give a terminal voltage of 3300V. Take the winding factor as unity. **(07 Marks)**

   c. A 6 pole, star connected alternator has a 90 slot and 8 conductor per slot, and rotates at 1000rpm. The flux per pole is 50 mwb. Find the induced emf across its lines. Take the winding factor of 0.97. **(07 Marks)**

OR

10 a. Mention the advantages and disadvantages of a squirrel cage and slip ring induction motors. **(07 Marks)**

   b. Why starter is required for a three phase induction motor? **(07 Marks)**

   c. A 6 pole induction motor is supplied by a 10 pole alternator. Which is driven at 600rpm. If the motor is running at 970rpm, find the slip. **(06 Marks)**

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First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
Engineering Physics

Time: 3 hrs.   Max. Marks: 100

Note: **1.** *Answer any FIVE full questions, choosing ONE full question from each module.*
       2. *Physical constants : Velocity of light, c = 3 × 10⁸ m/s*
                 Planck's constant, h = 6.625× 10⁻³⁴ JS
                 Boltzmann's constant, K = 1.38 × 10⁻²³ J/K
                 Avogadro's number, N_A = 6.02 × 10²⁶ /Kmole
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                 Charge of electron, e = 1.602 × 10⁻¹⁹ C
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Module-1

1   a.   Define simple harmonic motion. Derive the equation for simple harmonic motion using Hooke's law. Mention any five characteristics of simple harmonic motion.   **(10 Marks)**

    b.   State the laws of conservation of mass, momentum and energy along with the equations.
                                                              (06 Marks)

    c.   A mass of 5 kg is suspended from the free end of a spring. When set for vertical oscillations, the system executes 100 oscillations in 40 seconds. Calculate the force constant of the spring.   **(04 Marks)**

OR

2   a.   What are forced vibrations? Obtain an expression for amplitude of a body undergoing forced vibration.   **(10 Marks)**

    b.   Distinguish between subsonic and supersonic waves. Mention any two applications of shock waves.   **(06 Marks)**

    c.   Calculate the resonance frequency of a spring of force constant 1974 N/m, carrying a mass of 2000 gm.   **(04 Marks)**

Module-2

3   a.   State and explain Hooke's law. Define Young's modulus, Bulk modulus, Rigidity modulus and derive the respective equations.   **(08 Marks)**

    b.   Derive the relation y, η and σ.   **(08 Marks)**

    c.   Calculate the torque required to twist a wire of length 1.5 m, radius 0.0425×10^{-2} m, through an angle $(\pi/45)$ radian, if the value of rigidity modulus of its material is 8.3×10^{10} N/m².   **(04 Marks)**

OR

4   a.   Define bending moment. Derive the expression for the bending moment of a beam in terms of moment of inertia.   **(09 Marks)**

    b.   Define the terms elasticity and plasticity. Explain the stress-strain curve.   **(07 Marks)**

    c.   A rod of cross section of area 1 cm × 1 cm in rigidly planted into the earth vertically. A string which can withstand a maximum tension of 2 kg is tied to the upper end of the rod and pulled horizontally. If the length of the rod from the ground level is 2 meters, calculate the distance through which its upper end is displaced just before the string snaps.
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5 a. Explain the concept of divergence of a vector and its physical significance. State and derive Gauss divergence theorem. **(10 Marks)**

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c. Find the attenuation in an optical fiber of length 500 m when a light signal of power 100 mW emerges out of the fiber with a power 90 mW. **(04 Marks)**

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7 a. State and explain Heisenberg's uncertainty principle. Using this principle, prove that an electron does not exist inside the nucleus. **(08 Marks)**

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c. A particle of mass 0.5 Mev/c^2 has kinetic energy 100 eV. Find its de-Broglie wavelength. **(04 Marks)**

OR

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Module-5

9 a. Define Fermi factor. Discuss the dependence of Fermi factor on temperature and energy. **(08 Marks)**

b. What is internal field? Derive Clausius-Mossotti equation. **(08 Marks)**

c. The Hall coefficient of a material is -3.68×10^{-5} m^3/c. Identify the type of charge carriers and calculate the carrier concentration. **(04 Marks)**

OR

10 a. Derive the expression for electrical conductivity of a semiconductor. **(08 Marks)**

b. What are the main assumptions of quantum free electron theory and describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory. **(08 Marks)**

c. If a NaCℓ crystal is subjected to an electric field of 1000 V/m and the resulting polarization is 4.3×10^{-8} c/m^2, calculate the dielectric constant of NaCℓ. **(04 Marks)**

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First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. What are Reference Electrodes? Explain the construction and working of Calomel Electrode. **(07 Marks)**
    b. Define Single Electrode Potential. Derive Nernst equation for Single Electrode Potential. **(07 Marks)**
    c. Explain the construction and working of Li – ion battery. Mention its applications. **(06 Marks)**

OR

2   a. Explain Primary , Secondary and Reserve batteries with an example. **(06 Marks)**
    b. Explain the experimental determination of pH by using glass electrode. **(07 Marks)**
    c. A cell consists of Copper rod dipped in 5M $CuSO_4$ solution and Iron rod dipped in 0.05 M $FeSO_4$ solution. Given E^0_{Cu} = +0.34V and E^0_{Fe} = - 0.44V. Write Cell representation , Cell reactions and calculate Emf of the cell. **(07 Marks)**

Module-2

3   a. Define Corrosion. Describe Electrochemical theory of corrosion by taking Iron as an example. **(07 Marks)**
    b. What is Cathodic Protection? Explain Sacrificial Anodic method and Impressed Current method of Cathodic protection. **(07 Marks)**
    c. What is Metal Finishing? Mention technological importance of Metal Finishing. **(06 Marks)**

OR

4   a. Explain the factors affecting the corrosion rate :
       i)   Ratio of anodic to cathodic areas.
       ii) Nature of the corrosion product.
       iii) pH. **(06 Marks)**
    b. What is Corrosion Penetration Rate? A piece of corroded plate was found in the submerged ocean vessel. It was estimated that the original area of the plate was 10 $inch^2$ and that approximately 2.6kg had corroded away during the submersion for a period of 10 years. Calculate Corrosion Penetration Rate (CPR) in terms of mpy and mmy.   Given
       density (ρ) of iron = 7.9 g/dm^3
       mpy $\rightarrow$ k = 534
       mmy $\rightarrow$ k = 87.6. **(07 Marks)**
    c. What is Electroless Plating? Write the differences between Electroplating and Electroless plating. **(07 Marks)**

Module-3

5   a. What are Conducting Polymers? Explain the mechanism of conduction in Polyaniline. **(07 Marks)**
    b. Explain the synthesis , properties and applications of Poly Lactic Acid. **(06 Marks)**
    c. What are Nanomaterials? Explain the synthesis of Nanomaterials by Sol – gel process. **(07 Marks)**

OR

6 a. What are Polymer Composites? Explain the synthesis and applications of Kevlar fibre.
   (07 Marks)
   b. Explain any two size dependent properties of Nanomaterials. **(06 Marks)**
   c. Write a note on Fullerene and mention its applications. **(07 Marks)**

Module-4

7 a. What is Green Chemistry? Explain briefly any six basic principles of Green Chemistry.
   (07 Marks)
   b. Describe the production of hydrogen by Photocatalytic Water Splitting Method. **(06 Marks)**
   c. Explain the synthesis of Paracetamol by Conventional and Green Route Method. **(07 Marks)**

OR

8 a. Explain the impacts of Oxides of Nitrogen (NO_x) and Oxides of Sulfur (SO_x) on the Environment. **(06 Marks)**
   b. Explain the working of Photovoltaic cell, with a neat diagram. **(07 Marks)**
   c. Describe working of Methyl alcohol – Oxygen fuel cell [$CH_3 OH – O_2$] with a neat diagram. Mention its applications. **(07 Marks)**

Module-5

9 a. Explain Theory , Instrumentation and Applications of Colorimeter. **(07 Marks)**
   b. Explain the principle of Volumetric analysis and requirement of Volumetric analysis.
   (06 Marks)
   c. Define Biological Oxygen demand and Chemical Oxygen demand.
   25 mℓ of waste water required 18.0mℓ and 25.2mℓ of 0.1N FAS solution for sample and blank titration respectively. Calculate COD of the waste water sample. **(07 Marks)**

OR

10 a. Explain applications of Conductometry :
   i) Strong acid Vs Strong base   ii) Weak acid Vs Strong base. **(07 Marks)**
   b. Define the following units of Standard Solution :
   i) Normality   ii) Molarity   iii) PPM. **(06 Marks)**
   c. $25m^3$ of hard water sample titrated against 0.01M EDTA solutions consumed 18.0 cm^3 of EDTA solution. $25cm^3$ same sample of hard water was boiled , filtered and titrated against 0.01M EDTA solution consumed 12.0 cm^3 EDTA solution. Calculate Total , Permanent and Temporary hardness of the water sample. **(07 Marks)**

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First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Elements of Civil Engineering and Mechanics

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Briefly explain the scopes of Branches :
    i) Construction technology   ii) Water resources and Irrigation Engineering. **(10 Marks)**
  b. What are the roles of a Civil Engineer in Infrastructural development of a Country?
                                                                                    (05 Marks)
  c. What are the requirements of a good stone?   **(05 Marks)**

OR

**2** a. How does GIS work? What are the different ways of using GIS in Business and everyday life?   **(10 Marks)**
  b. What are the requirements of a good Brick?   **(05 Marks)**
  c. What are advantages and disadvantages of wood?   **(05 Marks)**

Module-2

3 a. State and prove Varignon's theorem.   **(06 Marks)**
  b. Two forces acting on a body are 500N and 1000N as shown in Fig. Q3(b). Determine the third force F such that the resultant of all the three forces are 1000N directed at 45° to the X - axis.   **(06 Marks)**

Fig. Q3(b)
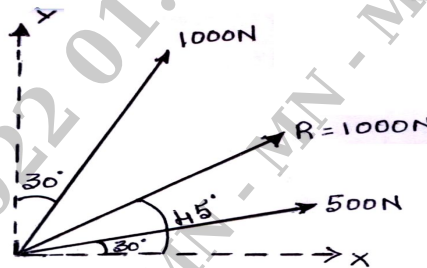
  c. A system of cables in equilibrium condition under two vertical loads of 300N and 500N as shown in Fig. Q3(c). Determine the forces developed in the different segments.   **(08 Marks)**
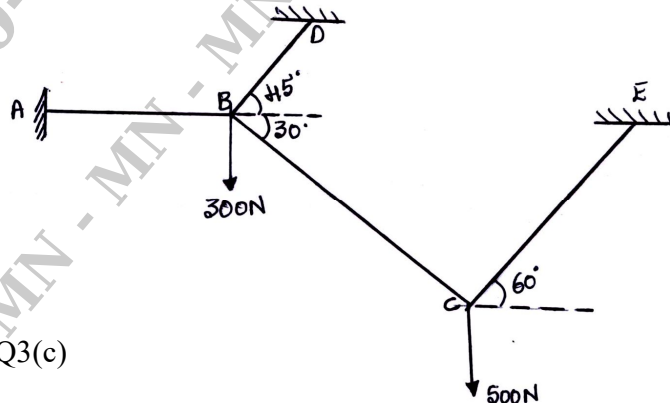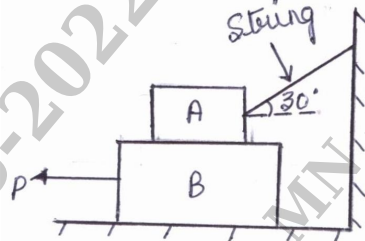

Fig. Q3(c)

OR

4 a. Briefly explain :
    i) Angle of friction   ii) Coefficient of friction   iii) Angle of repose.   **(06 Marks)**
   b. Find the force P first required to slide block B as shown in Fig. Q4(b). Find also the tension in the string. Take weight of block A = 500N , Weight of Block B = 1000N , μ = 0.2 (for all contact surface).   **(06 Marks)**

Fig. Q4(b)

   c. Find the value of P so that the body will not impend down the plane as shown in Fig. Q4(c). Also find the value of P for the body to impend up the plane. Take μ = 0.3.   **(08 Marks)**
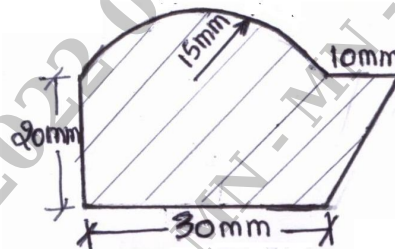
Fig. Q4(c)
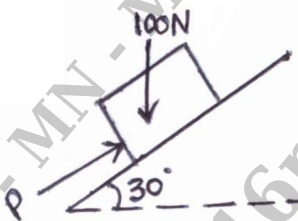
Module-3

5 a. Derive the expression for Centroid of a semi – circle from First principle.   **(08 Marks)**
   b. Determine the centroid of a shaded area of composite section as shown in Fig. Q5(b).   **(12 Marks)**
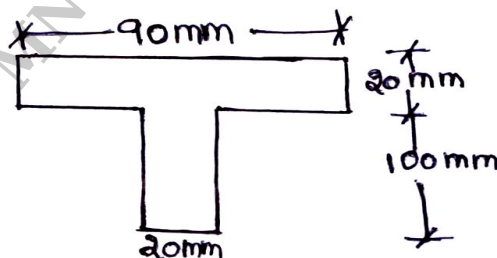
Fig. Q5(b)

OR

6 a. State and prove perpendicular axes theorem.   **(08 Marks)**
   b. Find the second moment of area as shown in Fig. Q6(b) about horizontal , vertical centroidal axis.   **(12 Marks)**
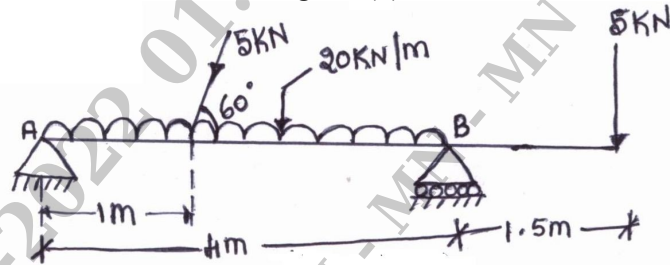
Fig. Q6(b)

Module-4

7 a. Explain different types of supports and loads with neat sketch. **(10 Marks)**

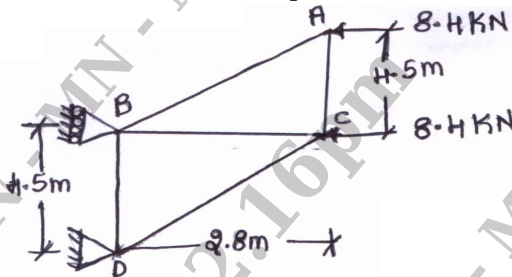b. Find the support reaction for the beam as shown in Fig. Q7(b). **(10 Marks)**

Fig. Q7(b)

OR

8 a. List the different types of Trusses. What are the assumptions made in the analysis of Trusses? **(10 Marks)**

b. Determine the force in each member of truss as shown in Fig. Q8(b) using method of joints. Also state whether each member is in tension or compression. **(10 Marks)**

Fig. Q8(b)

Module-5

9 a. What is Super Elevation? State the importance of Super Elevation. **(04 Marks)**

b. A Burglar's car starts with an acceleration of $2m/sec^2$. A police van came after 10 sec and continued to chase the Burglar's car with an uniform velocity of 40m/sec. Find the time taken by the police van to overtake the Burglar's car. **(08 Marks)**

c. A stone 'A' is dropped from top of a tower 50m height. At the same time another stone 'B' is thrown up from the foot of the tower with the velocity of 25m/sec. At what distance from the top and after how much time the two stones will cross each other. **(08 Marks)**

OR

10 a. State and explain D'Alembert's principle. **(04 Marks)**

b. The equation for the angle of rotation 'θ' is given by $\theta = 2t^3 - 5t^2 + 8t + 6$, where 't' is the time taken in seconds. Find i) The angular velocity   ii)   Angular acceleration of the body when t = 0 and t = 5 secs. **(08 Marks)**

c. A projectile is fired at certain angle with the horizontal has a horizontal range of 3.5km. If the maximum height reached is 500m, what is the angle of elevation of the Cannon? What was the Muzzle velocity of the projectile? **(08 Marks)**

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First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Basic Electronics and Communication Engineering

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. With a neat circuit diagram and waveforms, explain the working of Bridge rectifier without filter. **(08 Marks)**
    b. A 6V Zener diode has a maximum rated power dissipation of 500 mw. If the diode is to be used in a simple regulator circuit to supply a regulated 6V to a load of 500Ω. Determine a suitable value of series resistor for a supply of 12V. **(06 Marks)**
    c. With a neat block diagram, derive the expression for overall gain of a negative feedback amplifier. **(06 Marks)**

OR

2   a. Define the following with respect to Operational Amplifiers and write their typical values :
        i) Open loop voltage gain   ii) Input offset voltage   iii) Full power bandwidth and
        iv) Slew rate. **(08 Marks)**
    b. With a neat circuit diagram, explain the working of Integrator using Op-Amp. **(06 Marks)**
    c. With a neat circuit diagram, explain the working of Wein bridge Oscillator using Op-Amp. **(06 Marks)**

Module-2

3   a. With the help of truth table, explain full adder using logic gates. **(08 Marks)**
    b. Realize 8 - to – 1 multiplexer using basic gates. **(06 Marks)**
    c. With the help of logic diagram, explain the working of R – S bistable circuit. **(06 Marks)**

OR

4   a. With the help of neat block diagram, explain the working of Microcontroller System. **(08 Marks)**
    b. With a neat block diagram, explain the 4 – bit shift register using JK Flip – flop. **(06 Marks)**
    c. With a neat block diagram, waveforms and truth table, explain 3 – bit Asynchronous counter using JK Flip - flop. **(06 Marks)**

Module-3

5   a. What is an Embedded System? List any 7 comparison between Embedded system and General purpose computing system. **(08 Marks)**
    b. Explain the classification of Embedded system, based on Generation. **(06 Marks)**
    c. List the comparison between Microprocessor and Microcontroller. **(06 Marks)**

OR

6   a. With a neat block diagram, explain an Instrumentation System. **(08 Marks)**
    b. With a neat circuit diagram, explain Common Cathode and Common Anode 7 Segment LED display. **(06 Marks)**
    c. Write short notes on : i) I 2 C Bus and ii) S P I Bus. **(06 Marks)**

Module-4

7   a.   Describe the blocks of the Basic Communication System.   **(08 Marks)**
    b.   Explain the types of Communication System.   **(06 Marks)**
    c.   Define Amplitude Modulation. With the help of waveforms, explain Amplitude Modulation.   **(06 Marks)**

OR

8   a.   Explain three different modes of propagation of Electromagnetic waves, with a neat diagram.   **(08 Marks)**
    b.   With a neat block diagram, explain Transmitter and Receiver using Automatic Repeat Request.   **(06 Marks)**
    c.   Define an Antenna. Explain Yagi Antenna model with 3D Radiation pattern.   **(06 Marks)**

Module-5

9   a.   With a neat block diagram, explain Cellular Telephone System.   **(08 Marks)**
    b.   With a neat block diagram, explain GSM System Architecture.   **(06 Marks)**
    c.   Write a short note on WLAN.   **(06 Marks)**

OR

10   a.   With a neat block diagram, explain Satellite Communication.   **(08 Marks)**
     b.   With a neat block diagram, explain Analog link of an Optical Fiber Communication System.   **(06 Marks)**
     c.   Write a short note on Frequency Bands of Microwave Communication.   **(06 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐   21EME15

First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Elements of Mechanical Engineering

Time: 3 hrs.   Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
   2. *Use of Steam tables is permitted.*

Module-1

1 a. Explain the role of Mechanical Engineering in Industries and Society. **(06 Marks)**
   b. Explain formation of steam at constant pressure with T – h diagram. **(06 Marks)**
   c. Calculate the specific volume and enthalpy of 5kg of steam at 1.2 MPa
      i) When the steam is 12% wet   ii) When the steam is superheated at 360°C. **(08 Marks)**

OR

2 a. Determine the density of 1 kg of steam initially at a pressure of 10 bar absolute, having a dryness fraction of 0.78. If 500 kg of heat is added at constant pressure, determine the condition and internal energy for the final state of steam. Given specific heat of superheated steam = 2.1kJ/kg. K. **(10 Marks)**
   b. Explain with neat sketch, construction and working of a nuclear power plant. **(10 Marks)**

Module-2

3 a. Write short note on Smart material and shape memory alloys. **(08 Marks)**
   b. Give comparison of welding , soldering and brazing. **(08 Marks)**
   c. Give brief classification of Metals. **(04 Marks)**

OR

4 a. Explain briefly fibre reinforced and metal matrix composites. **(08 Marks)**
   b. Give a brief introduction of TIG and MIG welding. **(08 Marks)**
   c. Brief heat transfer in automobile radiators. **(04 Marks)**

Module-3

5 a. Explain the working of two stroke petrol engine with neat sketch. **(08 Marks)**
   b. Define the following with respect to refrigeration and air conditioning :
      i) COP   ii) Ton of refrigeration   iii) Refrigeration   iv) Refrigeration effect.
                                                            (08 Marks)
   c. List out components of Electrical and Hybrid vehicles. **(04 Marks)**

OR

6 a. What is a Refrigerant? What are its characteristics? **(08 Marks)**
   b. Briefly explain applications of IC engines in Power generation. **(08 Marks)**
   c. Mention advantages and disadvantages of EVs and hybrid vehicles. **(04 Marks)**

Module-4

7 a. A simple gear train consists of 3 gears. The number of teeth on the driving gear is 60, on the roller gear is 40 and on the driven gear is 80. If the driving gear rotates at 1200 rpm, find speed of driven gear and also the velocity ratio. Sketch the arrangement of gear drive.
                                                            (04 Marks)

b. Explain different types of belt drives with their applications. **(08 Marks)**
c. Briefly explain Robot Anatomy with neat figure. **(08 Marks)**

OR

8 a. It is required to transmit a power of 20kW between 2 parallel shafts by means of belt drive arrangement. The speeds of driving and driven shafts are 150 rpm and 250 rpm respectively. Distance between parallel shafts is 2.7m. Driven pully diameter is 60cm. Coefficient of friction between belt and pulley is 0.25. Determine the tensions and length of the belt for cross drive arrangement. **(08 Marks)**
b. Classify Robot configurations. Explain any two with neat sketch. **(08 Marks)**
c. Define Machines and Mechanisms. **(04 Marks)**

Module-5

9 a. Explain the construction and working of milling machine and applications. **(08 Marks)**
b. Explain Lathe Operations - Turning , Knurling , Boring , Taper turning. **(08 Marks)**
c. What are the components of CNC? **(04 Marks)**

OR

10 a. Explain Construction and working of lath. **(08 Marks)**
b. Explain the concepts of smart manufacturing and industrial IOT. **(08 Marks)**
c. Give a brief introduction of modern machining tools and techniques. **(04 Marks)**

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21MAT11

First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Calculus and Differential Equations

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1
a. With usual notation prove that $\tan\phi = r\dfrac{d\theta}{dr}$. **(06 Marks)**

b. Find the angle between the curves $r = a\log\theta$ and $r = \dfrac{a}{\log\theta}$. **(07 Marks)**

c. Find the radius of curvature for the cardioid, $r = a(1 + \cos\theta)$. **(07 Marks)**

OR

2
a. With usual notation prove that $\rho = \dfrac{(1+y_1^2)^{3/2}}{y_2}$. **(06 Marks)**

b. Show that $r = 4\sec^2\theta/2$ and $r = 9\,\mathrm{cosec}^2\,\theta/2$ the pair of curves cut orthogonally. **(07 Marks)**

c. Find the pedal equation of the curve $r^n = a^n\cos n\theta$. **(07 Marks)**

Module-2

3
a. Expand $\sqrt{1+\sin 2x}$ by Maclaurin's series up to the term containing x^4. **(06 Marks)**

b. If $u = f\left(\dfrac{x}{y}, \dfrac{y}{z}, \dfrac{z}{x}\right)$, prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z} = 0$. **(07 Marks)**

c. If $u = x + 3y^2 - z^3$, $v = 4x^2yz$, $w = 2z^2 - xy$ find $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}$ at $(1, -1, 0)$. **(07 Marks)**

OR

4
a. Evaluate $\displaystyle\lim_{x \to 0}\left(\dfrac{a^x + b^x + c^x}{3}\right)^{1/x}$. **(06 Marks)**

b. If $z = e^{ax+by} f(ax - by)$ prove that $b\dfrac{\partial z}{\partial x} + a\dfrac{\partial z}{\partial y} = 2abz$. **(07 Marks)**

c. Find the extreme values of $f(x, y) = x^3 + y^3 - 3x - 12y + 20$. **(07 Marks)**

Module-3

5
a. Solve $\dfrac{dy}{dx} + \dfrac{y}{x} = y^2 x$. **(06 Marks)**

b. Find the orthogonal trajectories of the family of curves $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2 + \lambda} = 1$, where λ is a parameter. **(07 Marks)**

c. Solve $x(y')^2 - (2x + 3y)y' + 6y = 0$. **(07 Marks)**

OR

6 a. Solve $(x^2 + y^2 + x)dx + xydy = 0$. **(06 Marks)**

b. If the temperature of the air is 30°C and a metal ball cools from 100°C to 70°C in 15 minutes, find how long will it take for the metal ball to reach a temperature of 40°C. **(07 Marks)**

c. Find the general solutions of $xp^2 + xp - yp + 1 - y = 0$. **(07 Marks)**

Module-4

7 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. **(06 Marks)**

b. Solve $(D^3 + D^2 - 4D - 4)y = 3e^{-x}$. **(07 Marks)**

c. Solve $\dfrac{d^2y}{dx^2} + y = \sec x \, \tan x$ using the method of variation of parameters. **(07 Marks)**

OR

8 a. Solve $(D^2 + 4)y = x^2$. **(06 Marks)**

b. Solve $\dfrac{d^2y}{dx^2} - 4y = \cosh(2x - 1)$. **(07 Marks)**

c. Solve $(x^2D^2 + xD + 9)y = 3x^2$. **(07 Marks)**

Module-5

9 a. Find the rank of the matrix.
$$\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}.$$
(06 Marks)

b. Solve by Gauss elimination method
$2x + y + 4z = 12$
$4x + 11y - z = 33$
$8x - 3y + 2z = 20$. **(07 Marks)**

c. Solve the system of equation by Gauss-Seidel method
$20x + y - 2z = 17$
$3x + 20y - z = -18$
$2x - 3y + 20z = 25$. **(07 Marks)**

OR

10 a. Find the values of λ and μ such that the system of equations:
$x + y + z = 6$
$x + 2y + 3z = 10$
$x + 2y + \lambda z = \mu$, may have
i) unique solution   ii) infinite solution   iii) no solution. **(06 Marks)**

b. Solve by the method of Gauss-Jordan method:
$2x + 5y + 7z = 52$
$2x + y - z = 0$
$x + y + z = 9$. **(07 Marks)**

c. Find the largest eigen value and the corresponding eigen vector of the matrix
$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$ by using the power method by taking initial vector as $[1, 1, 1]^T$.

(07 Marks)

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USN ☐☐☐☐☐☐☐☐☐☐ **21PHY12**

First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Engineering Physics

Time: 3 hrs.   Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Draw neat sketches wherever necessary.*
3. *Physical constants : Speed of light "C" = 3 × 10⁸ m/s⁻¹ ;*
Planck's constant "h" = 6.625× 10⁻³⁴ JS ; Boltzmann constant "K" = 1.38 × 10⁻²³ J/K⁻¹
Acceleration due to gravity "g" = 9.8 m/s⁻² ;
Permittivity of Free space "∈₀" = 8.854 × 10⁻¹² F/m⁻¹.

Module-1

1 a. What is Free and Forced Oscillation? Obtain expression for Amplitude and phase of vibration in case of forced vibration. **(09 Marks)**
b. Describe the construction and working of the Reddy shock tube. **(06 Marks)**
c. Calculate the peak amplitude of vibration of a system whose natural frequency is 1000 Hz when it oscillates in a resistive medium of damping / unit mass of 0.008 rad/s under the action of an external periodic force / unit mass of 5N/m with tunable frequency. **(05 Marks)**

OR

2 a. What is Force Constant? Obtain expression for effective Spring constant and Time period for two springs connected in series. **(08 Marks)**
b. Define Simple Harmonic Motion and give two examples. Obtain the differential equation for Simple Harmonic Motion using Hooke's Law. **(08 Marks)**
c. In a Reddy shock tube experiment, the time taken to travel between the two sensors is 195 μs. If the distance between the two sensors is 100mm. Calculate the mach number. Assume speed of sound as 340 m/s. **(04 Marks)**

Module-2

3 a. Discuss the spectral distribution of energy in the black body radiation spectrum and hence explain Wein's Displacement Law. **(06 Marks)**
b. Using the Schrodinger Time Independent wave equation , obtain expression for Energy Eigen values and the Normalized wave function. **(09 Marks)**
c. The position and momentum of an electron with energy 0.5 Ke V is found with a minimum percentage uncertainty in momentum. Find its uncertainty if the measurement of position has a uncertainty of 0.5A°. **(05 Marks)**

OR

4 a. What is Wave function? Arrive at the Time Independent Schrodinger Wave equation. **(08 Marks)**
b. State and explain Heisenberg's Uncertainty principle and hence use it to show that electrons do not exist inside the nucleus. **(08 Marks)**
c. Evaluate the De – Broglie wavelength of Helium Nucleus accelerated through a potential difference of 500V. **(04 Marks)**

Module-3

5 a. Distinguish between the types of optical fibres based on Refractive Index profile and number of modes of propagation. **(06 Marks)**

b. Obtain the expression for Energy density using Einstein's A and B coefficients. Draw inference on the condition $B_{12} = B_{21}$. **(10 Marks)**

c. A pulse from laser with power 1mW lasts for 10nS, if the number of photons emitted per pulse is 3.491×10^7. Calculate the wavelength of laser. **(04 Marks)**

OR

6 a. Discuss the construction and working of the CO_2 laser. Explain the significance of Helium gas in the CO_2 laser system. **(09 Marks)**

b. Give the basics of point to point communication using optical fibres. **(06 Marks)**

c. Calculate the NA , Relative RI , V number and the number of modes in an optical fiber of core diameter 50 μm and the core and cladding R.I are 1.41 and 1.40 respectively. Given Wavelength of source 820nm. **(05 Marks)**

Module-4

7 a. What is Fermi Factor? Discuss the dependence of Fermi factor on temperature and energy. **(08 Marks)**

b. Mention the four assumptions of Quantum free Electron theory and hence discuss any two success of Quantum free Electron theory. **(08 Marks)**

c. The resistivity of intrinsic germanium at 27°C is equal to 0.47 ohm meter. Assuming electron and hole concentration to be 0.38 m^2 V^{-1} S^{-1} and 0.18m^2 V^{-1} S^{-1}. Calculate the Intrinsic carrier density. **(04 Marks)**

OR

8 a. What is Hall effect? Obtain expression for the Hall voltage in terms of charge density also state importance of Hall effect. **(08 Marks)**

b. Define Internal Field. Derive the Clausius – Mossotti equation. **(07 Marks)**

c. Find the temperature of which there is 1% probability that a state with an energy 0.2eV above Fermi level is occupied. **(05 Marks)**

Module-5

9 a. Explain the construction and working of X – Ray diffractometer. **(07 Marks)**

b. Describe in brief the construction and working, with Principle the Transmission Electron Microscope. **(08 Marks)**

c. Determine the crystal size when the peak width is 0.5° and peak position 30° for a cubic crystal. The wavelength of X rays used is 100A° and the Scherer's constant K = 0.92. **(05 Marks)**

OR

10 a. With a neat sketch, explain the principle , construction and working of Scanning Electron Microscope. **(09 Marks)**

b. Describe the construction, principle and working of X – ray Photoelectron Spectroscope. **(08 Marks)**

c. Mention applications of Atomic Force Microscope. **(03 Marks)**

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First Semester B.E./B.Tech. Degree Examination, Feb./Mar. 2022
Problem Solving Through Programming

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain Components of Computer with block diagram. **(10 Marks)**
   b. Write a C program to find the area of triangle for the given three sides and draw flow chart. **(04 Marks)**
   c. Explain various types of Computers. **(06 Marks)**

OR

2 a. Write basic structure of C program and give brief explanation for each section with examples. **(10 Marks)**
   b. Define Operator. Explain any 6 operators with example. **(07 Marks)**
   c. Check the following identifiers are valid or invalid :
      i) sum100   ii) sum+3   iii) int   iv) abcd   v) X Y   vi) 2product. **(03 Marks)**

Module-2

3 a. Write the syntax of different branching statements and explain with example how they work. **(10 Marks)**
   b. Write a C program to perform all arithmetic operations for the given two integers using switch statement. **(06 Marks)**
   c. With the help of example and syntax, explain formatted input / output functions of C language. **(04 Marks)**

OR

4 a. Distinguish between while and do while statements. Explain with syntax and example. **(10 Marks)**
   b. Write a C program to check whether given number is prime or not. **(06 Marks)**
   c. Explain the use of break and continue inside for loop with example. **(04 Marks)**

Module-3

5 a. What is Array? How to declare and initialize 1D and 2D array? Explain with example. **(10 Marks)**
   b. Write a C program to sort the array elements using bubble sort. **(05 Marks)**
   c. Write a C program to implement linear search technique. **(05 Marks)**

OR

6 a. What is String? Explain any 4 string library functions with syntax and example. **(10 Marks)**
   b. Write a program to multiply 2 matrices by assuming their multiplication compatibility. **(10 Marks)**

Module-4

7 a. What is Function? Explain different categories of user defined functions. **(10 Marks)**

b. Write a C program for evaluating the binomial coefficient using a function Factorial (n). **(06 Marks)**

c. Explain Local and Global variables with example. **(04 Marks)**

OR

8 a. Differentiate i) User defined and built in function   ii) Recursion and Iteration. **(10 Marks)**

b. Explain Call by value and Call by reference with example. **(10 Marks)**

Module-5

9 a. What is Structure? Explain Structure declaration and Initialization with example. **(10 Marks)**

b. What is Union? How to declare Union? List out the differences and similarities between Structure and Union. **(10 Marks)**

OR

10 a. What is Pointer? How to declare and initialize pointers? Explain with example. **(06 Marks)**

b. Write a C program to find sum of two squared number using Macro square (n). **(06 Marks)**

c. Write a C program to find sum, mean, standard deviation of array elements using pointers. **(08 Marks)**

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