CBCS SCHEME

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18MAT11

First Semester B.E. Degree Examination, June/July 2024
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. Find the angle between the curves, $r = a(1 + \sin\theta)$ and $r = a(1 - \sin\theta)$. **(08 Marks)**

b. Show that for the curve $r(1 - \cos\theta) = 2a$, ρ^2 varies as r^3. **(06 Marks)**

c. Derive $\tan\phi = r\frac{d\theta}{dr}$ with usual notation. **(06 Marks)**

OR

2 a. Find the pedal equation of the curve $r^2 = a^2[\cos 2\theta + \sin 2\theta]$. **(08 Marks)**

b. If ρ be the radius of curvature at any point P(x, y) on $y^2 = 4ax$, show that $a\rho^2 = 4(x + a)^3$. **(06 Marks)**

c. Show that the evolute of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $(xa)^{2/3} + (yb)^{2/3} = (a^2 - b^2)^{2/3}$. **(06 Marks)**

Module-2

3 a. Expand $\log[1 + e^x]$ using Maclaurin's series upto the term containing x^3. **(06 Marks)**

b. Evaluate : $\lim_{x \to 0}\left[\frac{3^x + 4^x + 5^x}{3}\right]^{1/x}$. **(07 Marks)**

c. If $z = f(x, y)$ with $x = r\cos\theta$ and $y = r\sin\theta$ show that :

$$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial z}{\partial \theta}\right)^2.$$ **(07 Marks)**

OR

4 a. If $U = f(x - y, y - z, z - x)$ prove that $\frac{\partial U}{\partial x} + \frac{\partial U}{\partial y} + \frac{\partial U}{\partial z} = 0$. **(06 Marks)**

b. Find the Jacobian, $\frac{\partial(x, y, z)}{\partial(r, \theta, \phi)}$ from $x = r\cos\theta\cos\phi$, $y = r\cos\theta\sin\phi$ and $z = r\sin\theta$. **(07 Marks)**

c. Show that the rectangular box of maximum volume and a given surface area is cube. **(07 Marks)**

Module-3

5 a. Evaluate : $\iint_R x^2 y\,dx\,dy$, over the region bounded by the curves $y = x^2$ and $y = x$. **(06 Marks)**

b. Find the volume generated by the revolution of the cardioide $r = a(1 + \cos\theta)$ about the initial line, using double integral. **(07 Marks)**

c. Using definition of Gamma function, show that $\Gamma(\frac{1}{2}) = \sqrt{\pi}$. **(07 Marks)**

OR

6 a. Evaluate : $\int_{-a}^{a} \int_{0}^{\sqrt{a^2-x^2}} \sqrt{x^2+y^2}\,dy\,dx$ by changing into polar co-ordinates. **(06 Marks)**

b. Evaluate : $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dz\,dy\,dx$. **(07 Marks)**

c. Show that : $\int_0^\infty \sqrt{x}\, e^{-x^2} dx \times \int_0^\infty \frac{e^{-x^2}}{\sqrt{x}}\, dx = \frac{\pi}{2\sqrt{2}}$. **(07 Marks)**

Module-4

7 a. A body in air at 25°C cools from 100°C to 75°C in 1 minute. Find the temperature of the body at the end of 3 minutes. **(06 Marks)**

b. Find the orthogonal trajectories of the family of curves $r^n = a^n \sin n\theta$, where 'a' is a parameter. **(07 Marks)**

c. Solve : $y\left(\frac{dy}{dx}\right)^2 + (x-y)\frac{dy}{dx} - x = 0, p = \frac{dy}{dx}$. **(07 Marks)**

OR

8 a. Solve : $(2x^2 - 6xy)dy + (8xy - 9y^2)dx = 0$. **(06 Marks)**

b. Solve : $\frac{dy}{dx} + y^2 \tan x = y^3 \sec x$. **(07 Marks)**

c. The current 'i' in an electrical circuit containing an inductance L and a resistance R in series and, acted upon an e.m.f $E \sin \omega t$ satisfies the differential equation :

$$L\frac{di}{dt} + R.i = E \sin \omega t$$

Find the value of the current at any time, if initially there is no current in the circuit. **(07 Marks)**

Module-5

9 a. By applying elementary row operations find rank of :

$$\begin{bmatrix} 1 & 2 & 2 & 1 \\ 2 & 1 & 1 & 2 \\ 3 & 2 & 2 & 3 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$ **(06 Marks)**

b. Solve using Gauss – Seidel method [carry out 4 iterations] :

$6x + 15y + 2z = 72$
$27x + 6y - z = 85$
$x + y + 54z = 110.$ **(07 Marks)**

c. Diagonalize the square matrix $A = \begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$. **(07 Marks)**

OR

10 a. Apply Gauss – Jordan method to solve the following system of equations :

$2x + y + 3z = 1$
$4x + 4y + 7z = 1$
$2x + 5y + 9z = 3.$ **(06 Marks)**

b. Test for consistency, if consistent solve it.

$x + 2y + 3z = 14$
$4x + 5y + 7z = 35$
$3x + 3y + 4z = 21.$ **(07 Marks)**

c. Using Rayleigh's power method, find largest eigen value and the corresponding eigen vector of :

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

By taking $X^{(0)} = [1, 1, 1]^T$ as initial eigen vector. **(07 Marks)**

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18CHE12/22

First/Second Semester B.E. Degree Examination, June/July 2024
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 ion-selective electrodes? Explain the construction and principle of glass electrode. **(06 Marks)**

b. Describe the constructive and working of Lithium-ion battery. Mention its applications. **(07 Marks)**

c. An electrochemical cell consists of iron electrode dipped in 0.1 $FeSO_4$ and silver electrode dipped in 0.05M $AgNO_3$ solution. Write cell representation, cell reactions and calculate emf of the cell at 298 K. Given that the standard electrode potential of iron and silver electrodes are -0.44V and 0.8V respectively. **(07 Marks)**

OR

2 a. What is battery? Explain secondary and reserve battery with examples. **(06 Marks)**

b. Describe the construction and working of Nickel – metal hydride battery. Give its applications. **(07 Marks)**

c. What are electrolyte concentration cells? The emf of the cell

$$Cu \mid \underset{(0.001M)}{CuSO_4} \parallel \underset{(X\ M)}{CuSO_4} \mid Cu$$ is 0.0595 V at 298K. Find the value of X. **(07 Marks)**

Module-2

3 a. Define Corrosion. Explain the electrochemical theory of corrosion by taking iron as an example. **(07 Marks)**

b. Explain how the following factors affecting rate of corrosion :
i) Ratio of anodic to cathodic area ii) pH of the medium **(06 Marks)**

c. What is electroless plating? Explain the process of electroless plating of Nickel. **(07 Marks)**

OR

4 a. What is cathodic protection? Explain sacrificial anode and impressed current methods. **(07 Marks)**

b. Explain briefly the following factors:
i) Polarization of electrode ii) Over voltage. **(06 Marks)**

c. What is electroplating? Explain the process of electroplating of chromium. **(07 Marks)**

Module-3

5 a. Define HCV. Explain the experimental determination of calorific value of solid fuel using Bomb calorimeter. **(07 Marks)**

b. What are fuel cells? Describe the construction and working of solid oxide fuel cell. Give its applications. **(06 Marks)**

c. On burning 0.76×10^{-3} kg of solid fuel in a Bomb calorimeter, the temperature of 2.5kg of water is increased from 25°C to 28°C. The water equivalent of calorimeter and latent heat of steam are 0.486 kg and 2457 kJ/kg respectively. Calculate its HCV and LCV. Given specific heat of water = 4.187 kJ/kg/°C and percentage of hydrogen is 2.5. **(07 Marks)**

OR

6 a. Explain the preparation of solar grade silicon by union carbide process. **(07 Marks)**

b. Illustrate the construction and working of PV cell. Mention its advantages and disadvantages. **(07 Marks)**

c. What is Biodiesel? Explain the synthesis of Biodiesel with reaction and mention its advantages. **(06 Marks)**

Module-4

7 a. What are the main sources, effects and control of carbon monoxide pollution? **(07 Marks)**

b. Define Biomedical waste. Mention its sources, characteristics and disposal methods. **(07 Marks)**

c. Define COD. 25cm^3 of waste water mixed with 10 cm^3 of $K_2Cr_2O_7$, acidified and refluxed. The unreacted $K_2Cr_2O_7$ require 15.2 cm^3 of 0.3N FAS. In a blank titration 10 cm^3 of acidified $K_2Cr_2O_7$ require 19.4cm^3 of same 0.3N FAS. Calculate COD if waste water. **(06 Marks)**

OR

8 a. What is secondary air pollutant? Explain ozone depletion with reactions mention its effects and control measures. **(08 Marks)**

b. What is desalination? Describe the purification of sea water by reverse osmosis process. **(06 Marks)**

c. Explain the secondary and tertiary treatment of sewage. **(06 Marks)**

Module-5

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

b. Explain the instrumentation and applications of conductometry by taking following examples:

i) Strong acid with strong base ii) Weak acid with a strong base **(07 Marks)**

c. Write a note on carbon nanotubes. Mention its applications. **(06 Marks)**

OR

10 a. What are nanomaterials? Explain the synthesis of nanomaterial by precipitation method. **(07 Marks)**

b. Write a note on fullerenes. Mention its properties and applications. **(07 Marks)**

c. Explain the theory and instrumentation of colorimetry. **(06 Marks)**

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18PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2024
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 : $C = 3\times10^{8}$ m/s, $h = 6.63\times10^{-34}$ Js, $g = 9.8$ m/s^2, $e = 1.6\times10^{-19}$C, $N_A = 6.02\times10^{26}$/K mole, $k = 1.38\times10^{-23}$ J/K

Module-1

1 a. What is forced oscillations? Derive an expression for amplitude and phase in forced oscillations. **(10 Marks)**

b. Distinguish between acoustic wave, subsonic wave, supersonic wave and ultrasonic wave. **(06 Marks)**

c. The distance between the two pressure sensors in a shock tube is 150mm. The time taken by a shock wave to travel this distance is 0.3 ms. If the velocity of the sound under the same conditions is 340 m/s, find the Mach number of the shock wave. **(04 Marks)**

OR

2 a. Derive the expression for equivalent force constant for two springs connected in series and parallel. **(10 Marks)**

b. Define Simple Harmonic Motion. Write the characteristics of Simple Harmonic Motion. **(06 Marks)**

c. A man weighing 600N steps on a spring scale machine. The spring in the machine is compressed by 1cm. Find the force constant of the spring and angular frequency if the system is set for oscillations. **(04 Marks)**

Module-2

3 a. Define bending moment. Derive the expression for bending moment in terms of moment of inertia. **(10 Marks)**

b. Explain tensile stress and compressive stress. What are the engineering importance of elastic materials. **(06 Marks)**

c. A wire of length 2m and radius 2mm is fixed to the center of a wheel. A torque of magnitude 0.0395 Nm is applied to twist the wire. Find the rigidity modulus of the wire if the angular twist is 0.038 rad. **(04 Marks)**

OR

4 a. Derive the relation between Y, η and σ where Y is Young's modulus, η is rigidity modulus and σ - Poisson's ratio. **(10 Marks)**

b. State and explain Hooke's law. Define elastic and plastic limit. **(06 Marks)**

c. Calculate the extension produced in a wire of length 2m and radius of steel wire of 0.013×10^{-2} m due to a force of 14.7 N applied along its length. Given : Young's modulus of the material of the wire, $Y = 2.1\times10^{11}$ N/m^2. **(04 Marks)**

Module-3

5 a. What is attenuation in an optical fiber? Mention the factors contributing to the fiber losses. **(10 Marks)**

b. Explain the terms gradient of a scalar divergence and curl of a vector. **(06 Marks)**

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

OR

6 a. Explain the terms: Modes of propagation acceptance angle, numerical aperture and derive an expression for numerical aperture of an optical fiber. **(10 Marks)**

b. What is displacement current? Derive the expression for displacement current. **(06 Marks)**

c. A fiber of 500m long is having an input power of 100mW and output power of 90 mW. What is its attenuation? **(04 Marks)**

Module-4

7 a. State de-Broglie hypothesis. Show that an electron can't exist in the nucleus of an atom (relativistic case / non relativistic case). **(10 Marks)**

b. Elaborate the construction and working of a semiconductor laser. **(06 Marks)**

c. Find the ratio of population of the two energy states of a medium in thermal equilibrium the transition between which results in the spontaneous emission of photons of wavelength 694.3 nm. Assume ambient temperature as 27°C. **(04 Marks)**

OR

8 a. Set up one-dimensional time-independent Schrodinger wave equation. **(10 Marks)**

b. What are the conditions for laser production? Describe briefly the applications of laser in Data storage. **(06 Marks)**

c. Calculate the momentum of an electron and the de-Broglie wavelength associated with it, if its kinetic energy is 1.5 keV. **(04 Marks)**

Module-5

9 a. Give an expression for concentration of electrons and holes in an intrinsic semiconductor. Obtain the relation between Fermi energy and Energy gap of an intrinsic semiconductor. **(10 Marks)**

b. Describe in brief the various types of polarization. **(06 Marks)**

c. Find the polarization produced in a dielectric medium of relative permittivity 15 in presence of an electric field at 500 V/m. **(04 Marks)**

OR

10 a. Define the following : Fermi energy, Fermi velocity, Fermi temperature and Intrinsic and Extrinsic semiconductor with examples. **(10 Marks)**

b. Explain any two major failures of classical free electron theory. Describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory. **(06 Marks)**

c. For a metal having 6.5×10^{28} free electrons per unit volume, the relaxation time at room temperature 300 K is 3.82×10^{-14} second. Calculate its electrical conductivity using classical free electron theory. **(04 Marks)**

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18ELE13/23

First/Second Semester B.E. Degree Examination, June/July 2024
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 Ohm's law. Mention its limitations. **(05 Marks)**

b. Define the following with reference to AC quantities, (i) Instantaneous value (ii) Frequency (iii) Time period (iv) Form factor (v) Peak factor. **(07 Marks)**

c. A 8 ohms resistor is in series with a parallel combination of two resistors 12 ohms and 6 ohms. If the current in the 6 ohms resistor is 5 A, determine the total power dissipated in the circuit. **(08 Marks)**

OR

2 a. State and explain Kirchoff's laws. **(08 Marks)**

b. Derive for an average value of sinusoidal voltage in terms of its maximum value. **(06 Marks)**

c. For the circuit shown in Fig. Q2 (c), the total power dissipated is 488 W. Calculate the current flowing in each resistance and pd between A and B. **(06 Marks)**

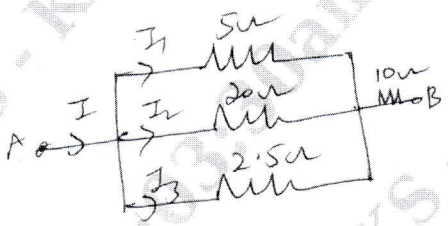

Fig.Q2 (c)

Module-2

3 a. List the advantages of three phase system over the single phase system. **(06 Marks)**

b. Prove that current in a purely inductive circuit lags behind the applied voltage by 90°. **(06 Marks)**

c. In a series parallel circuit, the two parallel branches A and B are in series with C. The impedances are $Z_A = (10 - j8)\Omega$, $Z_B = (9 - j6)\Omega$ and $Z_C = (3 + j2)\Omega$. The voltage across branch C is 100 V. Find the current Z_A and Z_B and phase difference between them. **(08 Marks)**

OR

4 a. Derive an expression for power in pure capacitor circuit and draw the voltage, current and power waveforms. **(06 Marks)**

b. In a three phase star connection, find the relation between line and phase values of currents and voltages. Also derive the equation for 3 phase power. **(06 Marks)**

c. Estimate the power factor in each of the following cases of Two Wattmeter method of measuring three phase power:

(i) Wattmeter readings are equal.

(ii) Wattmeter readings are equal and opposite.

(iii) Wattmeter readings are in the ratio 1 : 2

(iv) One Wattmeter reads zero. **(08 Marks)**

Module-3

5 a. Derive EMF equation of transformer. **(05 Marks)**

b. Define Earthing. Explain any pipe earthing with a neat diagram. **(08 Marks)**

c. A transformer is rated at 100 KVA. At full load its copper loss in 1200 W and its iron loss in 960 W. Calculate

(i) The efficiency at full load, unity power factor.

(ii) The efficiency at half load, 0.8 pf.

(iii) The load KVA at which maximum efficiency will occur.

(iv) Maximum efficiency at 0.85 pf. **(07 Marks)**

OR

6 a. Derive the condition for which the efficiency of a transformer is maximum. **(06 Marks)**

b. With neat sketches, explain 2-way and 3-way control of lamp with switching table. **(08 Marks)**

c. A 10 KVA, single phase transformer has a primary winding of 300 turns and secondary winding of 750 turns, cross section area of core in 64 cm^2. If primary voltage is 440 V at 50 Hz, find maximum flux density in the core emf induced in secondary of transformer. Calculate the efficiency of transformer at 0.8 pf lag if full load copper loss is 400 W and iron loss is 200 W. **(06 Marks)**

Module-4

7 a. Derive the EMF equation of DC generator. **(06 Marks)**

b. Sketch torque versus armature current and speed versus armature current characteristics of a DC motor and mention its applications. **(06 Marks)**

c. A 500 V DC shunt motor has 4 poles and wave connected winding with 492 conductors. The flux per pole is 0.05 wb. The full load current is 20 amps. The armature and shunt field resistances are 0.1 Ω and 250 Ω respectively. Calculate the speed and torque developed. **(08 Marks)**

OR

8 a. Explain with neat sketch, the constructional features of DC Generator and mention the function of each part. **(08 Marks)**

b. Derive an expression for the armature torque developed in a dc motor. **(06 Marks)**

c. A 4 pole generator with wave wound armature has 51 slots, each having 24 conductors. The flux per pole is 0.01 weber. At what speed must the armature rotate to give an induced emf of 220 V. What will be the voltage developed if the winding is lap connected and the armature rotates at the same speed. **(06 Marks)**

Module-5

9 a. Differentiate between salient pole type and non-salient pole type rotors of a synchronous generator. **(08 Marks)**

b. Define slip. Derive an expression for frequency of rotor current. **(05 Marks)**

c. A 2 pole, 3 phase alternator running at 3000 rpm has 42 armature slots with 2 conductors per slot. Calculate the flux/pole required to generate a line voltage of 2300 V. Distribution factor is 0.952 and pitch factor is 0.956. **(07 Marks)**

OR

10 a. Derive EMF equation of an Alternator. **(06 Marks)**

b. Explain the principle of operation of three phase Induction motor and give reason for an induction motor cannot run at synchronous speed. **(08 Marks)**

c. A 3 phase, 6 pole, 50 Hz Induction motor has a slip of 1% at no-load and 3% at full load. Determine :

(i) Synchronous speed
(ii) No-load speed
(iii) Full load speed
(iv) Frequency of rotor current at stand still
(v) Frequency of rotor current at full load. **(06 Marks)**

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18CPS13/23

First/Second Semester B.E. Degree Examination, June/July 2024
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. Explain the following :
i) Generations of computer
ii) Computer in a network. **(08 Marks)**

b. Define data type? Explain various data types available in C with an example. **(08 Marks)**

c. Identify whether the given variable names are valid or invalid with a suitable reason.
i) First_tag ii) Char iii) group one iv) int_type. **(04 Marks)**

OR

2 a. Explain the basic structure of C program with an example. **(08 Marks)**

b. Write a note on operator precedence and associativity. **(08 Marks)**

c. Evaluate the following expressions :
i) 100% 20 < = 20 – 5 + 100% 10 – 20 = = 5 > = 1! = 20
ii) a + = b * = c – – = 5 where a = 3, b = 5 and c = 8. **(04 Marks)**

Module-2

3 a. Explain the following with syntax and an example : i) if else ii) switch. **(08 Marks)**

b. Write a C program to compute the roots of a quadratic equation by accepting the coefficients and print appropriate messages. **(08 Marks)**

c. Explain the following : i) goto ii) break. **(04 Marks)**

OR

4 a. Write a C program for plotting Pascal of a triangle. **(08 Marks)**

b. Explain the formatted output statement with an example. **(08 Marks)**

c. Differentiate between while and do-while loop. **(04 Marks)**

Module-3

5 a. Explain the declaration and initialization of one dimensional array with an example. **(08 Marks)**

b. List all the string manipulation functions and explain string comparison and string copy functions with an example. **(08 Marks)**

c. Write a note on how a list of names can be stored in a two dimensional character array. **(04 Marks)**

OR

6 a. Write a program to sort the given set of N numbers using bubble sort. **(08 Marks)**

b. Explain the declaration and different way of initializing two dimensional array with an example for each. **(08 Marks)**

c. Write a program to copy one string into another and count the number of characters copied. **(04 Marks)**

Module-4

7 a. Explain in detail pass by value and pass by reference with an example for each. **(08 Marks)**

b. Explain the different categories of function with an example for each. **(08 Marks)**

c. Write a C program to convert binary number to decimal number using recursion. **(04 Marks)**

OR

8 a. Explain the following :
i) Function definition
ii) Function declaration
iii) Function call. **(08 Marks)**

b. What is recursion? Write a program to find the factorial of a given number using recursion concept. **(08 Marks)**

c. Write a program to swap two numbers by using call by reference. **(04 Marks)**

Module-5

9 a. Define structure? Explain the declaration and initialization of structure with an example. **(08 Marks)**

b. Explain the concept of pointer to pointer with an example. **(08 Marks)**

c. Write a note on array of structures. **(04 Marks)**

OR

10 a. Write a program to read, write and compute the average marks and the students solving above and below the average marks for a class of N students using structures. **(08 Marks)**

b. What is a pointer? Explain declaration and initialization of pointer with an example. **(08 Marks)**

c. Explain the following preprocessor directives. i) #define ii) #error. **(04 Marks)**

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18ELN14/24

First/Second Semester B.E. Degree Examination, June/July 2024
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. Illustrate the working of p-n junction diode under forward and reverse bias conditions with the help of circuit and V-I characteristics. **(08 Marks)**

b. With neat circuit diagram and waveform explain the working of center-tap full wave rectifier and derive the expression for average load current. **(08 Marks)**

c. Determine the range of (Vi) in which zener diode as shown below conducts.

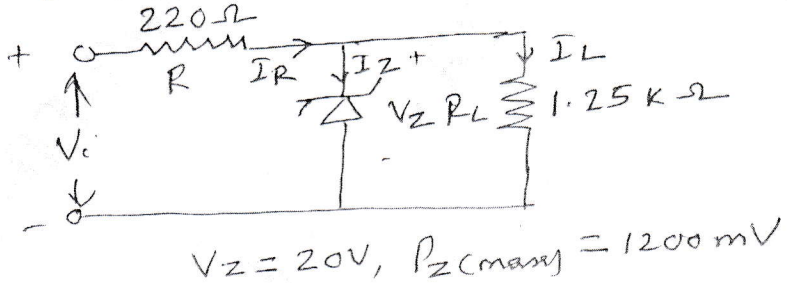

Fig.Q.1(c)

(04 Marks)

OR

2 a. Explain the operation of zener diode as a voltage regulator with load and without load by using necessary circuit diagram. **(08 Marks)**

b. Illustrate the operation of Light Emitting Diode (LED) and photo coupler. **(06 Marks)**

c. A diode circuit shown below has E = 2V, R = 20Ω. By assuming V_f = 0.3V, calculate 'I_f' for i) $r_d = 0$ ii) $r_d = 0.5\Omega$. **(06 Marks)**

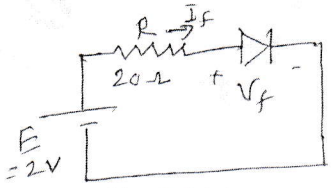

Fig.Q.2(c)

Module-2

3 a. Describe the differences between JFET and transistor. **(06 Marks)**

b. A certain JFET has an I_{GSS} of -2nA for V_{GS} = -20V. Determine the input resistance. **(04 Marks)**

c. Explain the construction and operation of JFET with necessary diagram. **(10 Marks)**

OR

4 a. What is MOSFET? Explain D-MOSFET and E-MOSFET transfer characteristics. **(08 Marks)**

b. Describe the operation of a CMOS inverter. **(06 Marks)**

c. Illustrate with diagram the operations of SCR using 2-transistor equivalent circuit. **(06 Marks)**

Module-3

5 a. Explain the working of Opamp non-inverting amplifier and obtain the expression for its voltage gain. **(08 Marks)**

b. Define the following terms:
i) Common mode gain
ii) CMRR
iii) Slew rate. **(06 Marks)**

c. Find the output (Vo) voltage of the following op amp circuit. **(06 Marks)**

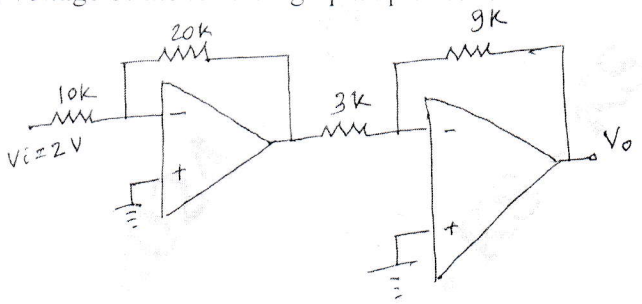

Fig.Q.5(c)

OR

6 a. Derive the output voltage for three input inverter summer circuit. **(08 Marks)**

b. Explain the working of integrator and derive the expression for its output voltage. **(06 Marks)**

c. Construct an adder circuit using op-amp to give the output voltage
$V_0 = -(4V_1 + 6V_2 + 5V_3)$ **(06 Marks)**

Module-4

7 a. Define amplifier. Explain with neat circuit diagram and necessary equation how the transistor acts as a amplifier. **(08 Marks)**

b. Construct an electronic switch using transistor and explain its operation with necessary equation. **(06 Marks)**

c. Explain the Barkhausen's criteria to build oscillations. **(06 Marks)**

OR

8 a. Define feedback amplifier. Derive the expression for voltage gain (A_f) for voltage series feedback amplifier with relevant diagram. **(06 Marks)**

b. Illustrate the operation of RC phase shift oscillator with neat circuit diagram and relevant equation. **(08 Marks)**

c. Explain with neat diagram the astable operation of IC555 timer. **(06 Marks)**

Module-5

9 a. Solve the following:
i) $(7354)_{10} = (?)_{16} = (?)_2$
ii) $(FA27E) = (?)_2 = (?)_8$ **(06 Marks)**

b. State and prove Demorgan's theorem using two variables. **(08 Marks)**

c. Construct full adder using two half adders with relevant Boolean expressions. **(06 Marks)**

OR

10 a. What is decoder? Explain the working of 3:8 decoder with neat diagram. **(06 Marks)**

b. Illustrate the working of a clocked SR flipflop with logic diagram and truth table. **(08 Marks)**

c. Explain the GSM system with neat block diagram. **(06 Marks)**

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18CIV14/24

First/Second Semester B.E. Degree Examination, June/July 2024
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. Missing data, if any may be suitably assumed.

Module-1

1 a. Explain briefly the scope of civil engineering in, (i) Transportation engineering (ii) Water resources and Irrigation engineering. **(08 Marks)**

b. What are the effects of infrastructural facilities on socio-economic development of a country? **(06 Marks)**

c. State and explain the law of transmissibility with its limitations. **(06 Marks)**

OR

2 a. State and prove Varignon's theorem of moments. **(06 Marks)**

b. Two cables attached at the top of a tower carries guy wire AB as shown in Fig. Q2 (b). Determine the tension in guy wire such that the resultant of forces in all the three cables acts vertically downwards. Also find the resultant force. **(10 Marks)**

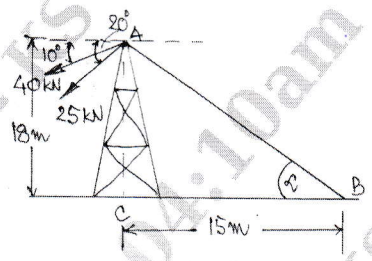

Fig. Q2 (b)

c. Find the components of 200 N force shown in Fig. Q2 (c) along general x and y axes shown.

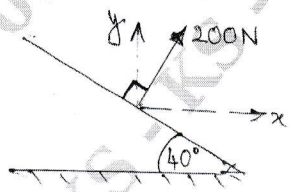

Fig. Q2 (c) **(04 Marks)**

Module-2

3 a. State and prove Lami's theorem. **(06 Marks)**

b. A system of cables with loads at joints B and C are shown in Fig.Q3 (b). Calculate the tension in the strings and also calculate the angle α. **(10 Marks)**

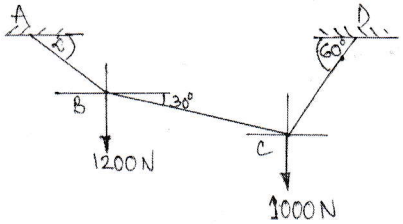

Fig.Q3 (b)

c. What is a free body diagram? Explain with an example. **(04 Marks)**

OR

4 a. State the laws of dry friction. **(06 Marks)**

b. A block of weight 1000 N is resting on an inclined plane as shown in Fig. Q4 (b). Find the magnitude of horizontal force P to cause impending motion of the block, (i) Up the plane (ii) Down the plane. Take coefficient of friction = 0.25. **(08 Marks)**

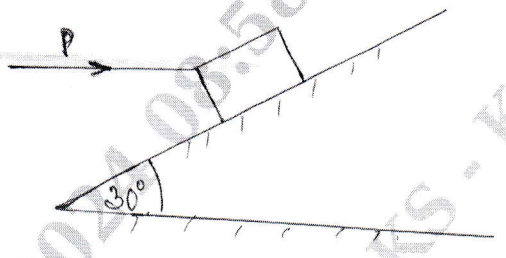

Fig. Q4 (b)

c. Show that the angle of friction is equal to angle of repose. **(06 Marks)**

Module-3

5 a. Explain the different types of beams. **(06 Marks)**

b. Determine the reactions developed at supports of the beam shown in Fig. Q5 (b).

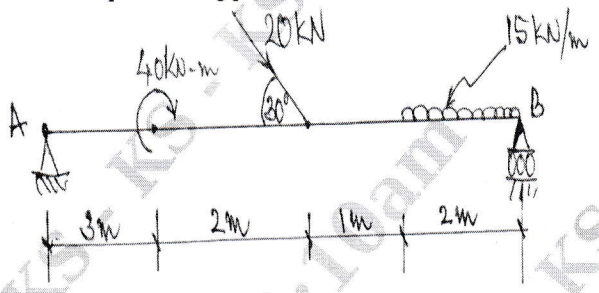

Fig. Q5 (b) **(10 Marks)**

c. Name the types of loads and explain any two of them. **(04 Marks)**

OR

6 a. What are perfect and imperfect trusses? Explain. **(06 Marks)**

b. List the assumptions in the analysis of trusses. **(04 Marks)**

c. Find the forces in the members of the truss shown in Fig. Q6 (c), using method of joints and tabulate member forces. **(10 Marks)**

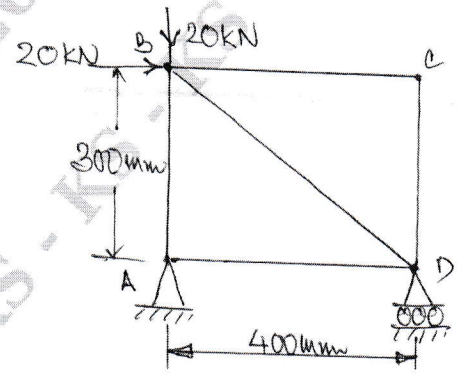

Fig. Q6 (c)

Module-4

7 a. Determine the expression for the centroid of an isosceles triangle from first principles. **(08 Marks)**

b. Locate the position of centroid for the lamina with a circular cutout shown in Fig. Q7 (b). **(12 Marks)**

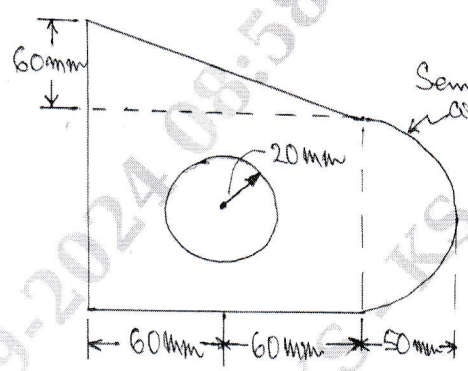

Fig. Q7 (b)

OR

8 a. Derive an expression for the moment of inertia of a circle by the method of integration. **(08 Marks)**

b. Determine the MI of section shown in the Fig. Q8 (b) about the centroidal axis. **(12 Marks)**

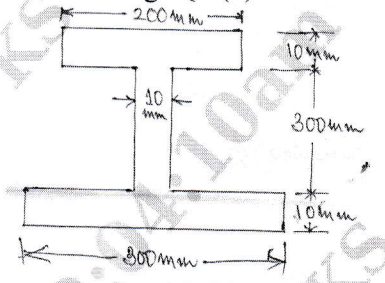

Fig. Q8 (b)

Module-5

9 a. Derive the equations of motion. **(08 Marks)**

b. A stone is dropped from the top of a tower 50 m high. At the same time, another stone is thrown up from the foot of the tower with a velocity of 25 m/sec. What distance from the top and after how much time the two stones cross each other. **(12 Marks)**

OR

10 a. Define the following terms :

(i) Projectile
(ii) Angle of projection
(iii) Horizontal range
(iv) Time of flight **(08 Marks)**

b. A projectile is fired from the top of cliff 150 m height with an initial velocity of 180 m/sec at an angle of elevation of 30° to horizontal. Neglecting air resistance, determine (i) the greatest elevation above cliff (ii) the great elevation above the ground reached by the particle (iii) the horizontal distance from the gun to the point where the projectile strikes the ground. **(12 Marks)**

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