N.B: Answer **SIX** questions taking **THREE** from each section. ) hours
The questions are of equal value.
Use separate answer script for each section.

## SECTION A

| | | Marks |
|---|---|---|
| Q.1(a) | Why do engineers need to know numerical methods? Can you explain some real life application of numerical methods? | 03 |
| (b) | What is the purpose of using round-off error, truncation error, absolute and relative error? Explain with example. | 04 |
| (c) | Obtain a root, correct to three decimal places for the following equation using bisection method. $-26 + 85x - 91x^2 + 44x^3 - 8x^4 + x^5 = 0$. | 05 |
| Q.2(a) | Solve the following systems of non-linear equation by using fixed point iteration method; $x^2 - y^2 = 4$, $x^2 + y^2 = 16$. | 06 |
| (b) | Given an equation $x \ln x = \ln 3$ in $[1, 2]$. (i) Prove that it has a unique solution in $[1, 2]$. And (ii) to find the solution numerically by bisection method with accuracy $10^{-4}$. How many steps should be carried out? | 06 |
| Q.3(a) | Detremine the real roots of $f(x) = -1 + 5.5x - 4x^2 + 0.5x^3 = 0$ using Newton-Rapshon method to within $\varepsilon_s = 0.01\%$. | 06 |
| (b) | Solve the following system of nonlinear equation by a suitable method: $x^2 = 3xy - 7$, $y = 2(x + 1)$. | 06 |
| Q.4 | The following values of a function f(x) have been obtained experimentally. | 12 |

| x | -1 | 2 | 4 |
|---|---|---|---|
| f(x) | 7.5 | 9.0 | 2.2 |

(i) Use Lagrange's method to find a quadratic approximation to f(x). Hence estimate f(0) and the positive value of x for which f(x) = 0. And (ii) Now let $I = \int_{-1}^{4} f(x)dx$. Estimate the value of I using trapezoidal rule. You should use all the data in the table (iii) Explain why it is not possible to use Simpson's rule on the data in the table. Find a suitable value of f(x) and hence obtain an estimate of I using Simpson rule.

## SECTION B

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Q.5(a) | The curve $y = ce^{bx}$ is fitted to the data: | | | | | | 04 |

| x | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| y | 1.5 | 4.6 | 13.9 | 40.1 | 125.1 | 299.5 |

Find the best values of c and b.

| | | |
|---|---|---|
| (b) | Estimate the value of $\int_0^1 \frac{1}{1 + 2x + 3x^2}$ using trapezoidal rule and Simpson's rule, where the value of h = 0.125. | 06 |
| (c) | How can you find the maximum and minimum value of a tabulated function? | 02 |
| Q.6(a) | Evaluate the following double integral: $\int_{-2}^{2}\int_{0}^{4} (x^2 - 3xy^2 + xy^3)dxdy$, where h = k = 2 using Simpson's 1/3 rule. | 06 |
| (b) | Solve the equation by iterative method: $10x_1 - 2x_2 - x_3 - x_4 = 3$; $-2x_1 + 10x_2 - x_3 - x_4 = 15$; $-x_1 - x_2 + 10x_3 - 2x_4 = 27$; $-x_1 - x_2 - 2x_3 + 10x_4 = -9$. | 06 |
| Q.7(a) | In case of one dimensional unconstrained optimization, use Newton's method to find the maximum of $f(x) = 2\sin x - x^2/10$. | 05 |
| (b) | Define (i) initial value problem (ii) boundary value problem (iii) Open method and (iv) Bracketing method. | 04 |
| (c) | State and prove Simpson's 3/8 rule. | 03 |
| Q.8(a) | Use the Runge Kutta second order method to solve $10\, dy/dx = x^2 + y^2$, $y(0) = 1$ for the range $0.5 \le x \le 1.0$. | 04 |
| (b) | Solve the boundary value problem $y'' - 64y + 10 = 0$; $y(0) = y(1) = 0$ by the finite difference method. Compute of y(0.5) and compare it with the true value. | 04 |
| (c) | Solve the following equations by using Jacobi's method. $10x_1 - 2x_2 - x_3 - x_4 = 3$; $-2x_1 + 10x_2 - x_3 - x_4 = 15$; $-x_1 - x_2 + 10x_3 - 2x_4 = 27$; $-x_1 - x_2 - 2x_3 + 10x_4 = -9$. | 04 |

Full Marks: [illegible] [illegible]ronics
[illegible] (03) hours

N.B:
Answer **SIX** questions taking **THREE** from each section.
The questions are of equal value.
Use separate answer script for each section.

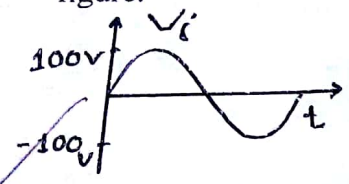
## SECTION A

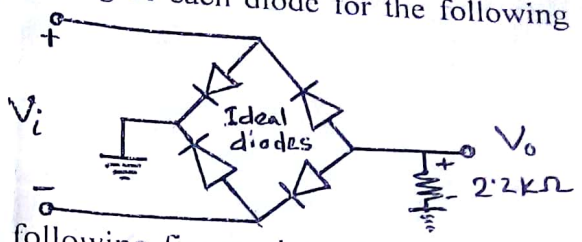
Marks

Q.1(a) Define intrinsic and extrinsic materials. How P-type and N-type materials can be formed? Explain. **04**

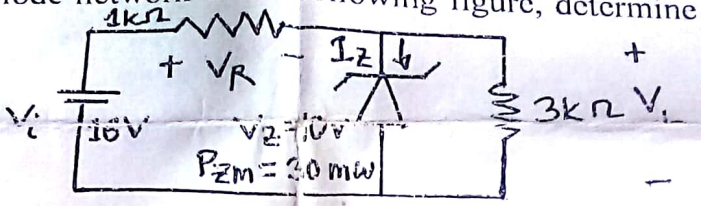
(b) Define PIV rating of a diode. Draw the I-V characteristics of a practical diode. What are the basic differences between zener-breakdown and avalanche breakdown? **04**

(c) Determine $V_0$ and the required PIV rating of each diode for the following figure. **04**

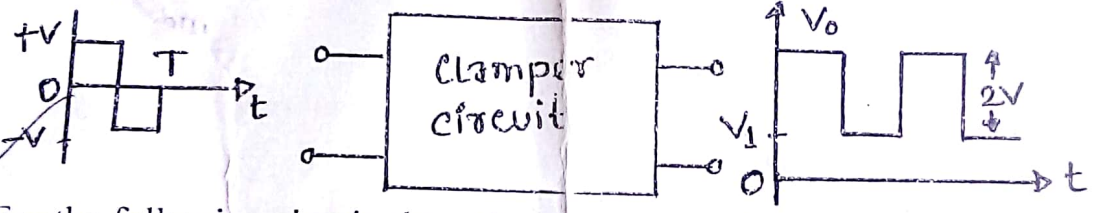


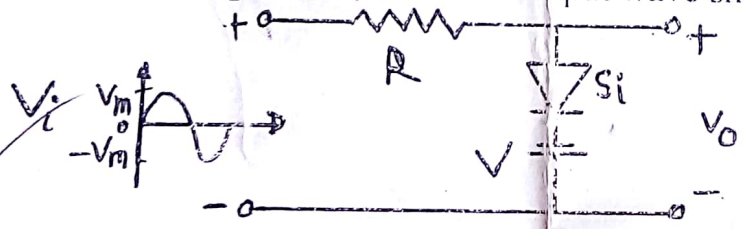

Q.2(a) For the zener diode network of the following figure, determine $V_L$, $V_R$, $I_Z$ and $P_Z$. **04**



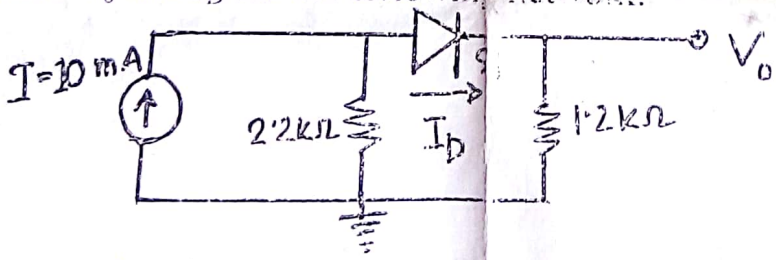

(b) Design a clamper circuit for the following input and output waveform. **03**




(c) For the following circuit, draw the output wave shape. **03**




(d) Determine $V_0$ and $I_D$ for the following network. **02**




Q.3(a) What is a transistor? Why is it so called? **03**

(b) Prove that $\beta = \alpha/(1 - \alpha)$; where the symbols have their usual meanings. **04**

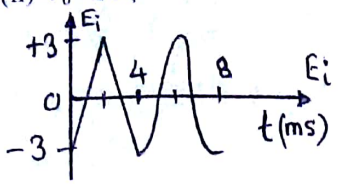
(c) Explain the operation of transistor as an amplifier in CE arrangement. **04**

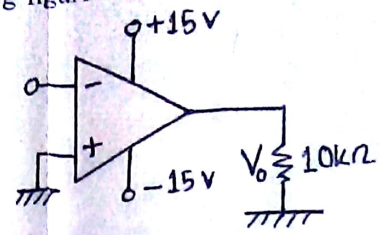
(d) What is Q-point? **01**

Q.4(a) Mention some features of a practical OP-AMP. Design an OP-Amplifier with a gain of +10. **04**

(b) Design an OP-AMP circuit for the following equation: 04
$V_0 = V_1 - V_2 + 5\int V_1 dt + 2dV_2/dt$.

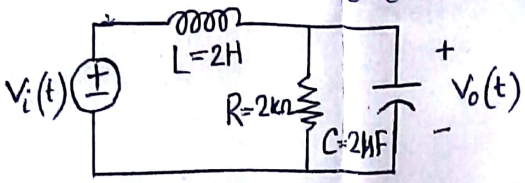
(c) What is comparator? $E_i$ is applied to the (-) input and ground to the (+) input of 741 OP-AMP in the following figure. Sketch accurately (i) $V_0$ VS.t and (ii) $V_0$VS.$E_i$. 04



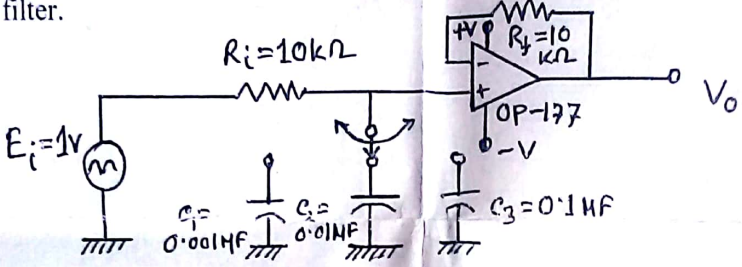

## SECTION B

Q.5(a) Draw an ideal frequency response of four types of filter. Determine what type of filter is shown in the following figure. 04




(b) Define wideband and narrowband filter. Draw the circuit diagram of a wideband filter using OP-AMP. 03

(c) Calculate the cutoff frequency for each value of C for the following low pass filter. 03




(d) Prove that the cutoff frequency $W_c = 1/RC$ for a high pass filter; where the symbols have their usual meanings. 02

Q.6(a) What do you understand by single-stage transistor amplifiers? Draw the circuit of a practical single stage transistor amplifier. 03

(b) Show that the output voltage of a single stage common emitter transistor amplifier is $180^0$ out of phase with the input voltage. 04

(c) Why is negative feedback is applied in high gain amplifiers? 02

(d) The overall gain of a multistage amplifier is 140. When negative voltage feedback is applied, the gain is reduced to 17.5. Find the fraction of the output that is feedback to the input. 03

Q.7(a) What is an oscillator? What are the advantages of it? 03

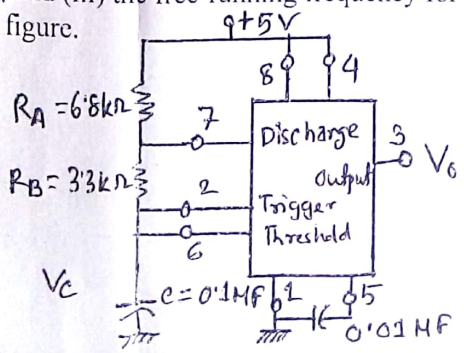
(b) Show that for phase shift oscillator the frequency of oscillations is $f_0 = 1/2\pi RC\sqrt{6}$; where the symbols have their usual meanings. 06

(c) Define a filter. What are the advantages of active filters over passive ones? 03

Q.8(a) Draw an internal circuit diagram of a 555 integrated circuit timer. Also write down some application of 555 timers. 04

(b) Explain the operation for the free-running astable multivibrator with wave shaper. 04

(c) Calculate (i) $t_{high}$ (ii) $t_{low}$ and (iii) the free-running frequency for the timer circuit of the following figure. 04



Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

B.Sc. Engineering 2nd Year ODD Semester Examination, 2017

Department of Computer Science & Engineering

Course No. Hum 2113 Course Title: Industrial Management & Accountancy

Full Marks: 72 Time: THREE (03) hours

N.B: Answer SIX questions taking THREE from each section.
The questions are of equal value.
Use separate answer script for each section.

## SECTION A

| | | Marks |
|---|---|---|
| Q.1(a) | What is Scientific Management? | 04 |
| (b) | Discuss the basic principles of Scientific Management? | 04 |
| (c) | Distinguish between Management and Administration. | 04 |
| Q.2(a) | Discuss the "Two-factor Theory" of Motivation. | 06 |
| (b) | Mention the benefits of a good wage incentive plan. Compare the advantages and disadvantages of 'Taylor's differential wage payment method and the piece rate with minimum guaranteed base wage method'. | 06 |
| Q.3(a) | What do you mean by performance appraisal and performance management? | 02 |
| (b) | State the typical steps in appraising employee performance. | 03 |
| (c) | Discuss potential rating scale appraisal problems. How to avoid them? | 07 |
| Q.4(a) | Define: Re-order point, lead time, and safety stock. | 02 |
| (b) | State the costs associated with holding low level inventory. | 03 |
| (c) | A company begins a review of ordering policies for its continuous review systems by checking the current policies for a sample of items. Followings are the characteristics of one item. Demand = 64 units/week (assume 52 weeks per year). Ordering and Setup costs = Tk 50/order. Holding costs = Tk 13/unit/year. Lead time = 2 weeks. Standard deviation of weekly demand = 12 units. Cycle service level 92 percent. (i) What is EOQ for the item? (ii) What is the derived safety stock? (iii) What is the reorder point? (iv) If on-hand inventory is 40 units, there is an one open order up by an EOQ and there is 30 units back order, is it time to reorder? (v) What are the cost implications if the current policy for this items is Q = 250 and R = 200? | 07 |

## SECTION B

| | | |
|---|---|---|
| Q.5(a) | What do you mean by Accounting? Discuss the basic principles of Accounting. | 04 |
| (b) | "Each transaction must have a dual effect on the basic accounting equation"-explain. | 03 |
| (c) | Journalize the following transactions in the book of Mr. Rahman for the month of June 2017:<br>June 1, started business with cash Tk 500000 and office equipments of Tk 100000.<br>June 5, Brought a Machine for cash Tk 300000.<br>June 10, Purchased goods from Kamal of Tk 30000.<br>June 12, Sold goods for cash Tk 50000.<br>June 20, Paid rent by cheque of Tk 15000. | 05 |
| Q.6(a) | Explain the differences between a product cost and period cost. | 03 |
| (b) | The record of the sunlight company shows the following information for the year ended 31st December 2016:<br>Raw materials used in Production→Tk 20000. Productive Labor→Tk 13000. Unproductive factory labor→Tk 7000. Factory supplies→Tk 2900. Sales Salaries→Tk 5000. Administrative Salaries→Tk 8000. Other factory expenses→Tk. 4600. Miscellaneous expenses→Tk 4000. Sundry administrative expenses→Tk 3500. Depreciation (75% manufacturing, 15% administrative and 10% selling)→Tk 1200. Goods completed and sold during the period was 5000 units and Sales price per unit was Tk 18.<br>**Required**<br>Prepare a statement showing the total cost of goods manufactured and profit earned. | 06 |
| (c) | What is Accounting Cycle? Explain the steps of Accounting Cycle? | 03 |
| Q.7(a) | Define variable cost and fixed cost. | 03 |
| (b) | What is meant by cost statement? | 03 |
| (c) | Explain (i) CM ratio (ii) M/S and (iii) BEP. | 06 |
| Q.8(a) | What do you mean by cost-volume profit relationships? How do increase of sales price and decrease of variable cost reflect on BEP? | 05 |
| (b) | The Munnu Ceramic Co. Ltd sold 12000 units of a product in 2016 at a price of Tk 150 per unit. Variable costs per unit were- direct materials Tk 30, direct labor cost Tk 40, factory overhead Tk 10. Total fixed costs were Tk 700000. Using the provided information you are required to:<br>i) Calculate BEP and CM ratio. (ii) Ascertain the amount of profit. (iii) What would be BEP if variable costs are reduced by Tk 5? (iv)Calculate sales volume to earn a profit of Tk 500000. (v) Calculate sale price if BEP was to be achieved at 8400 units. | 07 |

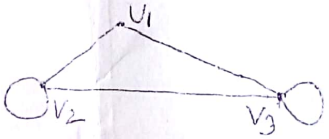
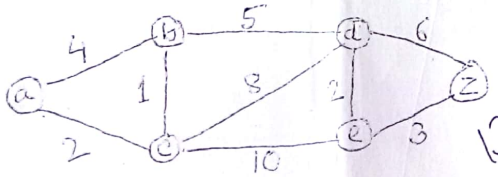
Heaven's Light is Our Guide
Rajshahi University of Engineering & Technology
B.Sc. Engineering 2nd Year ODD Examination, 2017
Department of Computer Science & Engineering
Course No. CSE 2101 Course Title: Discrete Mathematics
Full Marks: 72 Time: THREE (03) hours

**N.B:** Answer **SIX** questions taking **THREE** from each section.
The questions are of equal value.
Use separate answer script for each section.

## SECTION A

| | | Marks |
|---|---|---|
| Q.1(a) | Let Q (x, y) denotes "x + y = 0". What are the truth values of the quantifications $\exists_y \forall_x$ Q (x, y) and $\forall_x \exists_y$ Q (x, y), where the domain for all variables consists of all real numbers? | 04 |
| (b) | Show that the premises "A student in this class has not read the book", and "Everyone in this class passes the first exam." Imply the conclusion "Someone who passed the first exam. Has not read the book". | 04 |
| (c) | Give a proof by contradiction of the theorem " If 3n + 2 is odd, then n is odd". | 04 |
| Q.2(a) | Translate the following statement into a sentence in English. $\forall_m, n \in N ((m \div n) \in N \vee (n \div m) \in N)$. | 04 |
| (b) | What is the negation of the following statement? $\forall_x \in \mathbb{R}, \exists_y, \mathbb{R}, ((x = y^2) \vee (x<0))$. | 04 |
| (c) | Prove by mathematical induction that $4^n - 1$ is divisible by 3, for integer's $n \geq 1$. | 04 |
| Q.3(a) | Let $f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots\ldots + a_1 x + a_0$, where $a_0, a_1, a_2, \ldots\ldots a_{n-1}, a_n$ are real numbers. Show that f (x) is $O(x^n)$. | 04 |
| (b) | Suppose that $f_1(x)$ is $O(g_1(x))$ and $f_2(x)$ is $O(g_2(x))$. Show that $(f_1 f_2)(x)$ is $O(g_1(x)g_2(x))$. | 04 |
| (c) | What is the worst case complexity of the bubble sort in term of the number of comparisons made? Explain briefly. | 04 |
| Q.4(a) | Perform the following arithmetic operations: (i) A8 + C9 (base 16) and (ii) 101101 x 101 (base 2). | 04 |
| (b) | Find the solution of the recurrence relation: $a_{n+2} + a_{n+1} - 12a_n = 0$, $n \geq 0$ satisfying the initial conditions $a_0 = 1$ and $a_1 = 1$. | 04 |
| (c) | Find the general solution of the recurrence relation: $a_{n+2} - 2a_{n+1} - 3a_n = 3^n$, $n \geq 0$. | 04 |

## SECTION B

| | | |
|---|---|---|
| Q.5(a) | A computer system considers a string of decimal digits a valid codeword if it contains an even number of 0 digits. For instance, 1230407869 is valid, whereas 1209670543 is not valid. Let $a_n$ be the number of valid n-digit codeword. Find a recurrence relation for $a_n$. | 02 |
| (b) | What is the solution of the recurrence relation, $a_n = a_{n-1} + a_{n-2}$ with $a_0 = 0$ and $a_1 = 1$? | 04 |
| (c) | Let f be an an increasing function that satisfies the recurrence relation: $f(n) = a\, f(n/b) + c$ whenever n is divisible by b, where $a \geq 1$, b is an integer greater than 1, and c is a positive real number. Show that f (n) is $O(n^{\log_b a})$ if a > 1 and O (log n) if a = 1. When $n = b^k$, where k is a positive integers, show that $f(n) = c_1 n^{\log_b a} + c_2$ where $c_1 = f(1) + c/(a - 1)$ and $c_2 = -c/(a - 1)$. | 05 |
| Q.6(a) | Let A = {1, 2, 3, 4} and a relation R on A be given by – R = {(1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3), (4, 4)}. Draw the digraph of R. Is R an equivalence relation? Justify your answer. | 04 |
| (b) | Prove that if f, g : N→$\mathbb{R}$ , $f_1(n) = O(g_1(n))$ and $f_2(n) = O(g_2(n))$, then $f_1(n) + f_2(n) = O(\max(g_1(n), g_2(n)))$. | 04 |
| (c) | Use a truth table to improve that Modus Ponens is a valid argument. | 04 |
| Q.7(a) | Let f : N→R be defined by $f(n) = n^3 - 2n^2 - n + 1$. Prove from the definition that $f(n) = \theta(n^3)$. | 04 |
| (b) | Consider the following graph   (i) Give the adjacency matrix for the graph and (ii) Find the following if they exist- (I) an Eulerian circuit and (II) a Hamiltonian circuit. | 08 |
| Q.8(a) | Show that $K_n$ (complete graph with n vertices) has a Hamilton circuit whenever $n \geq 3$. | 04 |
| (b) | Find a shortest test path from a to z using Dijkstra algorithm for the following graph.   | 04 |
| (c) | Let G be a connected planar simple graph with e edges and v vertices. Let r be the number of regions in a planar representation of G. Show that r = e – v + 2. | 04 |

Light is Our Guide
Rajshahi University of Engineering & Technology
B.Sc. Engineering 2nd Year ODD Semester Examination, 2017
Department of Computer Science & Engineering
Course No. Math 2113 Course Title: Vector Analysis and Linear Algebra
Full Marks: 72 Time: THREE (03) hours

**N.B:** Answer **SIX** questions taking **THREE** from each section.
The questions are of equal value.
Use separate answer script for each section.

## SECTION A

**Marks**

**Q.1(a)** Determine whether the following vectors are linearly dependent or independent: $\vec{A} = 2\hat{i} + \hat{j} - 3\hat{k}$, $\vec{B} = \hat{i} - 4\hat{k}$, $\vec{C} = 4\hat{i} + 3\hat{j} - \hat{k}$. **04**

**(b)** Find the area of a parallelogram having diagonals $\vec{A} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{B} = \hat{i} - 3\hat{j} + 4\hat{k}$. **04**

**(c)** An aero plane travels 200km due west and then 150km $60^0$ north of west. Represent these displacements graphically and determine the resultant displacement analytically. **04**

**Q.2(a)** Find the directional derivative of div($\vec{u}$) at the point (1, 2, 2) in the direction of the outer normal of the sphere $x^2 + y^2 + z^2 = 9$ for $u = x^4\hat{i} + y^4\hat{j} + z^4\hat{k}$. **04**

**(b)** Find an equation for the tangent plane to the surface $xz^2 + x^2y = z - 1$ at the point (1, -3, 2). **04**

**(c)** If $\vec{v} = \vec{w} \times \vec{r}$, prove $\vec{w} = \frac{1}{2}$ curl $\vec{v}$, where $\vec{w}$ is a constant vector. **04**

**Q.3(a)** Show that $\vec{F} = (2xy + z^3)\hat{i} + x^2\hat{j} + 3xz^2\hat{k}$ is a conservative force field. Find the scalar potential. Also find the work done in moving an object in this field from (1, -2, 1) to (3, 1, 4). **06**

**(b)** Evaluate $\iint_s \vec{A} \cdot \vec{n}\, ds$, where $\vec{A} = 18z\hat{i} - 12\hat{j} + 3y\hat{k}$ and s is that part of the plane $2x + 3y + 6z = 12$ which is located in the first octant. **06**

**Q.4(a)** State and prove Stokes theorem. **06**

**(b)** Verify Green's theorem in the plane for $\oint_c (2x - y^3)dx - xydy$, where c is the boundary of the region enclosed by the circle $x^2 + y^2 = 1$ and $x^2 + y^2 = 9$. **06**

## SECTION B

**Q.5(a)** Define adjoint matrix. Find the adjoint of **06**

$$B = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 4 \\ 1 & 4 & 3 \end{pmatrix}$$ and hence find its inverse.

**(b)** Define symmetric and skew-symmetric matrices with example. Find the normal form of the following matrix and hence find its rank. **06**

$$A = \begin{bmatrix} 2 & -1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \\ 2 & 5 & 11 & 6 \end{bmatrix}.$$

**Q.6(a)** Solve the following system of linear equations: **06**

$2x - 2y + 5z + 3w = 0$
$4x - y + z + w = 0$
$3x - 2y + 3z + 4w = 0$
$X - 3y + 7z + 6w = 0.$

**(b)** Find all the Eigen values and any one eigen vector of the following matrix: **06**

$$A = \begin{bmatrix} 3 & -5 & -4 \\ -5 & -6 & -5 \\ -4 & -5 & 3 \end{bmatrix}.$$

**Q.7(a)** State Cayley-Hamilton theorem. Verify Cayley-Hamilton theorem for the following matrix and hence find its inverse. **06**

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -3 & 1 \end{bmatrix}.$$

**(b)** Consider the matrix **06**

$$A = \begin{bmatrix} 2 & 2 \\ 1 & 3 \end{bmatrix}.$$

(i) Find a non-singular matrix P such that D $= P^{-1}AP$ is diagonal and (ii) Compute $A^{15}$ using diagonal factorization.

**Q.8(a)** What is linear mapping? Let F: $\mathbb{R}^2 \to \mathbb{R}^2$ be the linear operator defined by- F(x, y) = (2x + 3y, 4x – 5y). Find the matrix representation of F relative to the basis S = { (1, 2), (2, 5)}. **06**

**(b)** Define spanning set in vector space. Determine whether or not the following vectors of $\mathbb{R}^3$ form a spanning set: u = (1, 1, 1), v = (1, 1, 0), w = (1, 0, 0).