

Shahjalal University of Science & Technology, Sylhet.

Institute of Information & Communication Technology

Software Engineering

1st Year 1st Semester Exam, 6th July, 2017

Course Title: Calculus & Differential Equations **Course Code:** MAT-102

Time: 3 Hours **Total Marks:** 100

Group A

(From 1 to 13 answer any 10 questions)

(5*10)

1. Find the domain and range of the functions-

- i. $f(x) = \sqrt{x^2 - 1}$ ii. $f(x) = (\frac{1}{2})^x$ iii. $f(x) = \sin x + 2$
iv. $f(x) = \ln(x+1)$ v. $f(x) = e^{-2x}$

2. Define derivative of a function.

Let $f(x) = \begin{cases} x & \text{for } 0 < x \leq 2 \\ x - \frac{1}{2}x^2 & \text{for } x > 2 \end{cases}$

Discuss the existence of $f'(x)$ for $x = 2$

3. Differentiate $\cos^{-1} \frac{1-x^2}{1+x^2}$ with respect to $\tan^{-1} \frac{2x}{1-x^2}$

4. If $y = e^{3x} \sin 4x$, find y_n (n^{th} derivative of y)

5. Define minimum and maximum value of a function at a point. Given $xy = 4$, find the maximum and minimum value of $4x + 9y$

6. State and prove Rolle's theorem.

7. Expand $\ln(1+x)$ in Maclaurin's series.

8. State Leibnitz's theorem.

If $y = \sin(m \sin^{-1} x)$ then show that-

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

9. Let $f(x, y) = x^3y + x^2y^2 + y^4$. Find f_x

and hence show that,

$$xf_x + yf_y = 4f(x, y)$$

10. If $y = f(x+ct) + \phi(x-ct)$, show that-

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$$

11. Give the definition of definite integral as limit of a sum.

Evaluate -

$$\lim_{n \rightarrow \infty} \left\{ \left(1 + \frac{1}{n}\right) \left(1 + \frac{2}{n}\right) \dots \left(1 + \frac{n}{n}\right) \right\}^{\frac{1}{n}}$$

12. Evaluate $\int x \sin^2 x dx$

13. Evaluate $\int \sin^2 x \cos^3 x dx$

Group B

(From 14 to 26 answer any 10 questions)

(5*10)

14. Evaluate the following-

$$\int_0^{\frac{\pi}{2}} \frac{dx}{4 + 5 \sin x}$$

15. Show that $\int_0^{\pi} \ln(1 + \cos x) dx = \pi \ln \frac{1}{2}$

16. Obtain the reduction formula for -

$$\int_0^{\frac{\pi}{4}} \tan^n x dx$$

17. Find the area of the region bounded by the curves $y = 2 - x^2$ and $y = -x$

18. Find the volume of the solid generated by revolving the region bounded by $y = \sqrt{x}$,

$y = 1, x = 3$ about the line $y = 1$

19. Find the volume of the solid revolving by the region bounded by the curve $y = x^2 + 1$ and the line $y = -x + 3$ about the x-axis.

20. Find the volume and surface area of the solid generated by revolving the Cardioids $r = a(1 - \cos \theta)$ about the initial line.

21. Define differential equation. Find the differential equation of -
$$xy = Ae^x + Be^{-x}$$

22. Solve the homogeneous differential equation:

$$(x^3 + y^3)dx - xy^2 dy = 0$$

23. Solve the homogeneous differential equation:

$$x \frac{dy}{dx} + y = y^2 \log x$$

24. Solve the differential equation:

$$y'' - 2y' + y = 0, \quad y(0) = 1, y'(0) = -1$$

25. Solve the differential equation:

$$\frac{d^2x}{dt^2} - 5 \frac{dx}{dt} + 6x = x^2$$

26. Solve the following differential equation:-

$$(D - 1)^2 y = x^2 e^x$$

Shahjalal University of Science & Technology

Institute Of Information and Communication Technology

Discipline: Software Engineering

1st Year 1st Semester Final Examination, 2017

BNG Session: 2016 -17

Course No: BAN -105 Course Title: Bangla Language

Credits: 3.0 Full Marks: 100 Time: 3 Hours

[উভয় বিভাগ থেকে সকল প্রশ্নের উত্তর দিতে হবে]

Group A

- ১। উদাহরণসহ টিকা লেখ। (যে-কোন তিনটি) ৩x৫=১৫
অভিজ্ঞতা; মৌলিক স্বরধ্বনি; বাগ্যজ্ঞ; অপিলিইতি; শাসঘাত; পদ।
- ২। প্রমিত বাংলা বানানের দশটি নিয়ম উদাহরণসহ লেখ। ১০
অথবা,
সূত্র উল্লেখ করে বানান শুল্ক করা। (যে-কোন পাঁচটি) ৩x৫=১৫
দ্বাধারী, ব্রাঞ্জন, মাঝিখন, প্রাচিমোগিকা, শাহিদ, পুঁজুপী, পুরুষাদ
- ৩। যে-কোন একটি বিষয়ে প্রবন্ধ লেখ। ১০
ক. বাংলার লোকসংস্কৃতি; খ. আধুনিক তথ্যপ্রযুক্তি; গ. মুক্তিযুদ্ধ ও গণহত্যা
- ৪। 'বাঙালা ভাষা' প্রবন্ধে প্রবন্ধিক বাংলা রচনার উৎকৃষ্ট রীতি সম্পর্কে যে অভিমত ব্যাক্ত করেছেন, তার স্বরূপ
নির্ণয় করা। ১০
অথবা,
যৌবনের রাজাটিকা প্রদানের পক্ষে প্রাবন্ধিকের যুক্তিগুলো আলোচনা কর।

Group B

- ৫। উচ্চারণশহন অনুযায়ী বাংলা ব্যঙ্গনক্ষণিকে কয় ভাগে ভাগ করা যায়? উদাহরণসহ সংজ্ঞেপে পরিচয় দাও। ১০
৬। সূত্রসহ শুল্ক উচ্চারণ লেখ। (যে-কোন পাঁচটি) ১০
শৰ্ম; বিজ্ঞান; নম্ব; অবিচার; স্বর্দেশ; পর্গ; কাজল।
- ৭। ভাষারীতি বলতে কি বোঝ? বাংলা ভাষার সাধুরীতি থেকে চলিতরীতিতে রূপান্তরের নিয়মগুলো তুলে ধর। ১০
- ৮। সনেট কাকে বলে? সনেট হিসেবে মধুসূদন দত্তের 'বঙ্গভাষা' কবিতার সার্থকতা নিরূপণ কর। ১০
অথবা,
লালন সাহিয়ের 'খাঁচার ভেতর অচিন পাথি' অবলম্বনে জীবাম্বা-পরমাম্বা তষ বর্ণনা কর।
- ৯। 'পৃষ্ঠবীতে কে কাহার'-উক্তিটির আলোকে 'পোষ্টমাস্টার' গবের জীবনবাস্তবতার স্বরূপ বিশ্লেষণ কর। ১০
অথবা,
'পুইমাচা' কীসের প্রতীক? ফেন্টির জীবনের সঙ্গে পুইমাচাটির আন্তঃসম্পর্ক আলোচনা কর।

Shahjalal University of Science & Technology

Institute of Information and Communication Technology

Discipline: Software Engineering

1st Year 1st Semester Examination, 2017

Session: 2016-17

Course: SWE 121 (Structured Programming Language)

Full Marks: 100

Time: 3 Hours

Note: Answer four questions taking any two from each group. Figures at right margin show marks.

Group - A (Answer any two questions)

- 1.a) Explain the basic data types in C. Show how data types are modified. 5
b) Determine which of the following identifiers are valid. If invalid explain why. 5

i. S.E.C.	iv. student	vii. SWE_221	ix. sizeof
ii. Ox01	v. b\$failure	viii. Statement	x. _7th
iii. MiNote2	vi. class		

- c) Distinguish which of the following identifiers are keywords and library functions. 3
void, for, sqrt(), break, putchar(), long.
d) Consider the program fragment in Fig. 1. What will be the value of a and b after the fragment is executed. 4

```
int main() {
    int a;
    float b;
    a = 19 % 3;
    b = 19 % 3;
    printf("a=%d\b\tb=%d", a, b);
```

Fig. 1

- a. $2 * ((k / 5) + (4 * (j - 3)) \% (k + j - 2))$
- b. $c == 99$
- c. $(x > y) \&\& (k > 0) \parallel (j < 5)$
- d. $++x$
- e. $2 * x + (y == 0)$

Fig. 2

- e) A C program contains the following declarations and initial assignments: 5

```
int k = 8, j = 5;
float x = 0.005, y = -0.01;
char c = 'c', d = 'd';
```

Determine the value of each of the following expressions given in Fig. 2.

- f) How are comments used in a C program? Give examples. 3

- 2.a) Write the output of the following program fragments shown in Figs. 3 and 4. 6

```
int main() {
    int marks=61;
    if(marks >=80) printf("Excellent");
    if(marks >=60) printf("Good");
    if(marks >=40) printf("Poor");
    else printf("Fail");
}
```

Fig. 3

```
int main() {
    for (i = 0; i < 10; i++) {
        if(i==5) break;
        printf("%d", i);
    }
}
```

Fig. 4

- b) Rewrite the program in Fig. 3 using *switch* statement. 3
c) What will be the output if the *break* statement in Fig. 4 is replaced with the *continue* statement? 3
d) Reconstruct the following program so that it produces the output as given aside. 5

```
int main(){
    int i, j;
    for (j=0;j<5-i; j++)
        printf("\n");
    for(i=0; i<5; i++) {
        printf("+");
    }
}
```

Output:

```
+++++
++++
+++
```

- e) Distinguish the statements $i = 5$, $i == 5$ and $i += 5$ with example. 3
f) Write a function that finds the factorial of an integer. The function must follow the prototype:
Long int factorial (int n). 5

- 3.a) What is the purpose of *#include* directive in a C program? 2
b) What are the purpose of the following library functions? How are they used?
ceil(), *tolower()*, *isalpha()*, *pow()*, *isupper()*. 5
c) Write an appropriate function call for each of the following functions. 4

i. int funct(int x) { return x*x; }	ii. void display(float a, float b) { float c; c = sqrt(a * a + b * b); printf("c = %f\n", c); }
--	---

- d) What do *call by value* and *call by reference* mean? 4
e) Write a program to swap two integer values by passing references to a function. 5
f) What are the differences between global and local variables? Show with example. 5

Group - B
(Answer any two questions)

- 4.a) What will be the output of the following programs?

8

<pre>i. int main() { int i, y = 0; int x[10] = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}; for (i = 0; i < 10; ++i) { if ((x[i] % 2) == 0) y += x[i]*x[i]; printf("%d\n", y); } }</pre>	<pre>ii. int main() { int a, b, c; int z[3][3] = {1,2,3,4,5,6,7,8,9}; for (a = 0; a < 3; ++a) { c=10; for (b = 0; b < 3; ++b) if (z[a][b] < c) c = z[a][b]; printf("%d ",c); } }</pre>
--	---

- b) Write a program to find the maximum and minimum value of an array. 5
 c) What is the purpose of the return statement? How does it relate to **void**? 2
 d) Write a recursive function that will calculate the sum of even numbers from 0 to N. N must be taken from user using **scanf** function. 5
 e) Write a program that will evaluate the series: $1 + 3 + 5 + \dots + n = \text{result}$ 5
 i. using a **for** loop
 ii. using a **do-while** loop,
 where **n** will be user input and **result** should be calculated and printed.

- 5.a) What are the advantages of using pointer? 2
 b) Distinguish between a string and a character array. 3
 c) Write a program to compare two strings S1 and S2. 4
 d) What is the output generated by the following program? 5

```
#include<stdio.h>
```

```
int main(){
    int x=20, y;
    int *px, *py;
    px=&x;
    y=*px+20;
    py=&y;

    printf("%d %d\n",y,*px);
    printf("%d %d\n",x,*py);
    return 0;
}
```

- e) Define a 3×4 array and assign the following values to the array elements: 3

1	2	3	4
5	6	7	8
9	10	11	12

- f) Display the array elements in similar matrix form. 4
 g) Display the same in transpose form. 4

- 6.a) Define a structure **account** with members **name**, **accno**, and **balance**. Declare an array of type **account**. 5
 b) Write a program to read the data for 10 customers. Display the name of the customers having balance over 1,000000/. 6
 c) Distinguish the file opening modes 'r', 'w', 'r+', and 'w+'. 4
 d) Write a program to write the account information in 6(a) into a text file. 5
 e) Rewrite the program in 6(d) to display the information reading from the text file. 5

Group A

1. Answer the questions in one line or less. [15x1]

Any 15

- (a) Is $x + 3 = 2$ a proposition?
- (b) If $C(x)$: "x had coffee" and $T(x)$: "x had tea" then Express the proposition: "Every student either had coffee or had tea" using proper Quantifier.
- (c) Find the truth value of $\exists n (5n = 7n)$ if n is integer.
- (d) If A, B and C are sets then find $(A - C) \cap (C - B)$?
- (e) Express decimal 323 in base 6
- (f) Find GCD of 2341 and 4199
- (g) Find LCM of 2341 and 4199
- (h) Find the pseudo random numbers using $x_{n+1} = (7x_n + 4) \bmod 8$ for $x_0 = 3$
- (i) Find if the Relation R is Reflective, Symmetric, Anti-Symmetric, Transitive or none of the above. $R = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$
- (j) $f(x) = 4x + 2$ $g(x) = 3x + 7$ find $f \circ g$ and $g \circ f$
- (k) Determine if the function from Z to Z is one-to-one, onto, both or none: $f(n) = n^2 + 1$
- (l) Find C and k for $f(x)$ is $O(x)$ $f(x) = 3x + 7$
- (m) What is the sequence of the generating function $f(x) = \frac{1}{1-ax}$?
- (n) A map is drawn with 23 vertices and 79 edges, how many countries are there?
- (o) Will you be able to draw the Olympic Symbol without lifting your pen?
- (p) What is the probability of getting 8 if two dices are rolled?
- (q) Which set of operators are functionally complete in Boolean algebra?
- (r) Express X-OR gate in terms of NOR gates.

2. Answer any three questions: [3x5]

(a) Prove $\neg(p \vee (\neg p \wedge q)) \equiv \neg p \wedge \neg q$ using logical equivalence relations.(b) Draw the graph of function $F(x) = |x-2| + |x+2|$ for $-5 \leq x \leq 5$ (c) Use algorithm to find $2^{24} \bmod 647$ (d) Draw the graph $G = (V, E)$ where the seven vertices are given by $V = \{AB, BC, BF, CD, CE, DE, EB\}$. The directed edges are given by $E = \{\text{between the vertices where end letter of one vertex is same as the start letter of the other vertex}\}$. Does it have Euler circuit? Euler Path? Write all of them.

3. Answer any two questions [2x10]:

(a) Find the solution of the recurrence relation: $a_n = 2a_{n-1} + a_{n-2} - 2a_{n-3}$ if $a_0 = 0, a_1 = 1$ and $a_2 = 2$ (b) (i) Determine whether each of these functions from $[a, b, c, d]$ to itself is one-to-one and onto.

- a. $f(a) = b, f(b) = a, f(c) = c, f(d) = d$
- b. $f(a) = b, f(b) = b, f(c) = d, f(d) = c$
- c. $f(a) = d, f(b) = b, f(c) = c, f(d) = d$

(ii) Encrypt the word IICTSUST using the function $f(p) = (3p+2) \bmod 26$ where $\{p\} = \{0, 1, 2, 3, \dots, 25\}$ for Letters $\{A, B, C, \dots, Z\}$ (c) (i) RSA encryption of an integer M is given by $C = M^e \bmod (pq)$ where p, q are prime numbers. If $p = 5$ and $q = 7$, Find the smallest e and use that to find C for $M=11$. (ii) RSA decryption is given by $M = C^d \bmod (pq)$ find d if $p = 5, q = 11$ and $e = 3$. If $C = 18$ decrypt to find M .

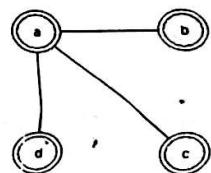
Group B

4. Answer the questions in one line or less. [15x1]

- (a) What is the truth value $\forall x (\Omega^3 > x^2)$ if x is a real number?
 (b) If $F(x)$ = "x is a monkey" and $J(x)$ = "x eats banana", then translate $\exists x(F(x) \wedge J(x))$
 (c) Express 32148 in its prime factors.
 (d) What is power set. Show using example.
 (e) How many primes are in between 10000 and 100000?
 (f) $2^{61} - 1$ is a Mersenne prime. Write the prime number in binary number system.
 (g) True or False? $23 \equiv 16 \pmod{7}$
 (h) Arrange the following function as increasing complexity: $\log n, n \log n, b^n, n!, \text{constant}, n^b$
 (i) Is the relation $R = \{(1,1), (1,2), (1,3), (1,4), (2,2), (2,3), (2,4), (3,3), (3,4), (4,4)\}$ symmetric or anti-symmetric?
 (j) Find the value of $\lfloor \frac{1}{2} + \lceil \frac{3}{2} \rceil \rfloor \cdot \lfloor \frac{1}{2} \cdot \lceil \frac{7}{2} \rceil \rfloor$
 (k) State De Morgan's law.
 (l) Define Θ if $f(x)$ is $O(g(x))$ and $f(x)$ is $\Omega(g(x))$
 (m) Find the generating function if $a_k = \frac{1}{k!}$
 (n) What is the chromatic number of a Bipartite graph.
 (o) True or False: Two graphs are isomorphic if they have same number of vertices, edges and degrees.
 (p) A tree traversed in pre-order, in order and post order are ABC, BAC and BCA, draw the tree
 (q) What are the operations of Boolean Algebra?
 (r) Draw the circuit $X \cdot Y + Y \cdot Z$

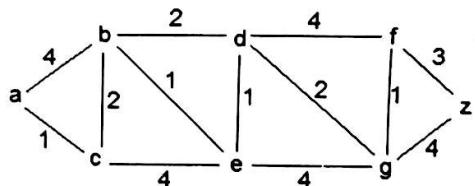
5. Answer any three questions: [3x5]

- (a) Show that $f(n) = 1 + 2 + 3 + \dots + n$ is $O(n^2)$
 (b) Show that the Tower of Hanoi problem can be solved in $2^n - 1$ moves.
 (c) Generate pseudo-random numbers using $x_{n+1} = (ax_n + c) \pmod{m}$ where $a = 7, c = 4$ and $x_0 = 3$. Find a suitable m which will generate a reasonably long sequence.
 (d) Find the number of paths of length 4 from a to d, starting from product of adjacency matrix.



6. Answer any two questions [2x10]:

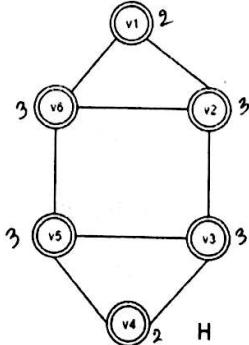
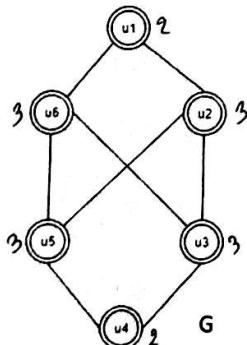
- (a) Using Dijkstra's algorithm find the shortest path for the given graph. Make sure you follow all the logical steps of the algorithm.



- (b) i. A binary tree representing $((x+y) \uparrow 2) + ((x-4)/3)$

- Draw the tree
- Traverse in pre-order fashion showing steps

- ii. Determine whether graphs G and H shown below are isomorphic. Explain why or why not.



- (c) Design a digital circuit which will produce HIGH output only when the prime numbers from 0 to 9 are applied using four inputs as binary sequence. Follow the following steps: (i) use sum of products for selecting the given numbers between 0 and 9 (ii) Use Karnaugh map for minimizing the sum of products (iii) If possible minimize more using the don't-care terms (iv) draw the circuit using two input gates.

[Answer four questions taking any two from each group.]

Group A

- Q1 a) Give two practical examples of two-dimensional motion. 2
 b) Obtain the equation of a projectile motion. What is its geometrical shape? 2
 c) Show that the range of the projectile is dependent on angle of projection if the initial velocity remains constant. 5
 d) The moon moves round the earth in 27.3 days. If the radius of its circular motion is 2.38×10^3 miles, what is its magnitude of acceleration towards the Earth? 4
 e) A projectile is fired with initial velocity $v_0 = 95 \text{ m/s}$ at an angle $\theta = 50^\circ$. After 5 s it strikes the top of a hill. What is the elevation of the hill above the point of firing? 5
- Q2 a) State Newton's laws of motion. Using force, length and time as fundamental quantities, what is the dimension of a mass? 3+2
 b) Describe two ways in which you can experience weightlessness. 2
 c) How can you show by an experiment that the inertial mass and gravitational mass are equal. 2
 d) Write the Kepler's law of planetary motion. 2
 e) A body of mass 300 kg rests on a bed of a truck that is moving at a speed 100 km/h. The driver applies the brake and slows to a speed 60 km/h in 15 seconds. What force acts on the body during this time? 4
 f) Derive an expression for work done by a one dimensional variable force. 2
 g) State and prove Work-Energy thermo. 4
 h) A spring is found to be stretched 3 cm from its equilibrium when a force of 0.75 N acts on it. Then a 5 gm body is attached to the end of the spring and is pulled to 5 cm along a horizontal frictionless table from the equilibrium position. The body is then released. What is the force constant of the spring and the period of oscillatory motion? 2+2
- Q3 a) How can you classify the waves? Write an equation for a travelling wave. 2+1
 b) What is superposition of waves? 1
 c) How can one create plane wave and spherical wave? 1
 d) The equation of a transverse wave traveling in a rope is given by $y = 15 \sin(\pi(0.02x - 2.00t))$, where y and x are expressed in centimeters and t in second, respectively. Find the amplitude, frequency, velocity and wavelength of the wave. 4
 e) What is Doppler's effect? Is the Doppler effect applicable for all waves? 1+1
 f) Find the general Doppler's effect equation for the sound wave which holds for all situations of the source and detector. 10
 g) A toy rocket moves at a speed of 242 m/s directly toward a stationary pole while emitting sound waves at frequency $f = 1250 \text{ Hz}$. What frequency f' is sensed by a detector that is attached to the pole? 4

Group B

- Q4 a) What is impulse? Explain impulse-momentum theorem. 2+3
 b) Define elastic and inelastic collision. 3
 c) Let two masses m_1 and m_2 moving initially with velocities v_1 and v_2 respectively. Calculate their final velocities after colliding elastically. What will happen when masses are equal? 6+2
 d) Find the fractional decrease after kinetic energy of a neutron when it collides head on with a lead nucleus? The mass of the lead nucleus is 206 times greater than neutron. 3
 e) State and explain the Newton's law of gravitation. 3
 f) A satellite in circular orbit at an altitude h of 230 km above Earth's surface has a period T of 89 min. What is the mass of the Earth? 3
- Q5 a) What is thermometry? Discuss the physical properties of different substances for the construction of a thermometer. 1+5
 b) Describe the construction and working formula of the constant volume hydrogen thermometer. 9
 c) At what temperature do the Celsius and the Fahrenheit scales coincide? 3
 d) How can you say that the first law of thermodynamics is the expression for principle of conservation of energy? Define isothermal and adiabatic processes with examples. What will be the form of the first law when the system is adiabatic? 2+3+2
- Q6 a) What is a black body? What do you mean by black body radiation? 1+1
 b) Discuss Wien's law of distribution of energy. 3
 c) Describe Planck's law of black body radiation. How is Planck's law applicable for all wavelengths? 4+6
 d) Calculate the radiation emittance of a black body at a temperature of (i) 400 K and (ii) 4000 K. 3
 e) Show that the efficiency of Carnot engine using an ideal gas as working substance can be expressed as $e = \frac{T_1 - T_2}{T_1}$, where T_1 and T_2 are temperatures of the source and the sink, respectively. 7

Part - A

(Answer any two of the following questions)

1. (a) Calculate the power supplied or absorbed by each element in Fig. 1
 (b) Calculate the equivalent resistance R_{ab} in the circuit in Fig. 2

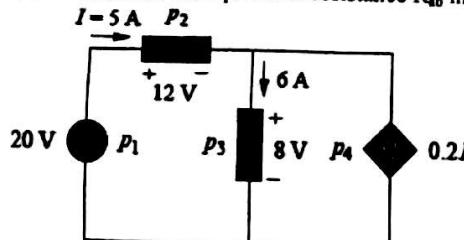


Fig. 1

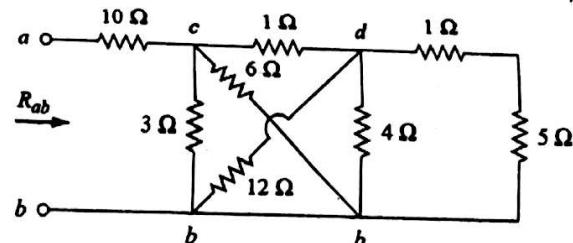


Fig. 2

- (c) Two identical light bulbs X and Y in Fig. 3, which are rated at 60 W; 240 V, are connected in series to a 240 V source as shown in the diagram below. If point A in the circuit is now connected to point B by a piece of copper wire with very low resistance, how will the brightness of each bulb change?

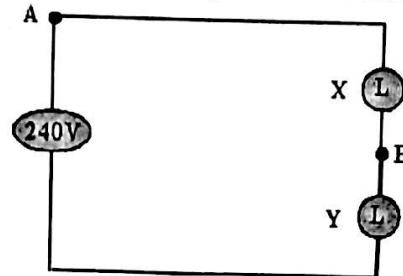


Fig. 3

- (d) Find v_o and i_o in the circuit of Fig. 4

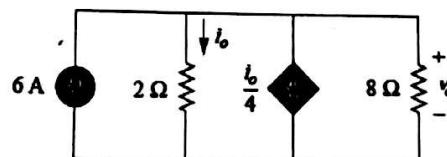


Fig. 4

2. (a) Find v and i for the circuit in Fig. 5 using Nodal Analysis.

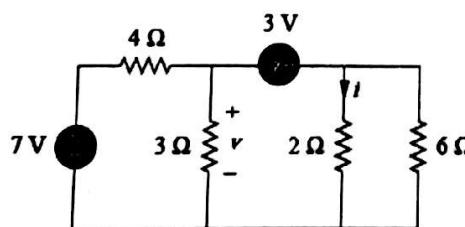


Fig. 5

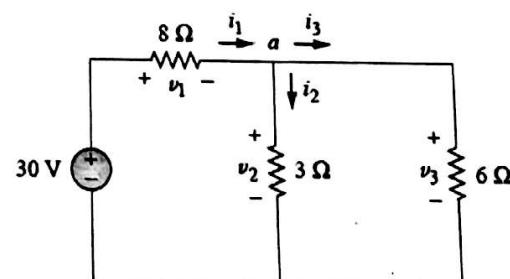


Fig. 6

- (b) Find currents and voltages in the circuit shown in Fig. 6

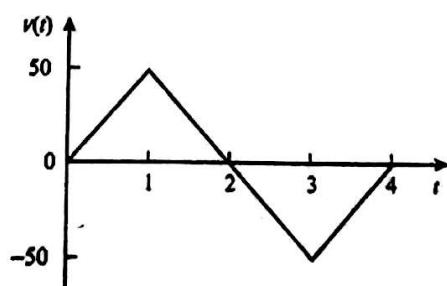


Fig. 7

- (c) Determine the current through a 200 μF capacitor whose voltage is shown in Fig. 7

- (d) Assume there are 10 lightbulbs that can be connected in parallel and 10 lightbulbs that can be connected in series as like in Fig. 8, each with a power rating of 40 W. If the voltage at the plug is 110 V for the parallel and series connections, calculate the current through each bulb for both cases.

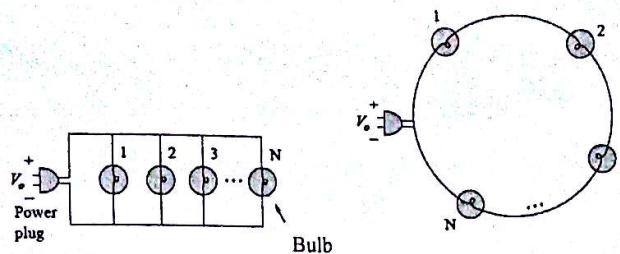


Fig. 8

3. (a) Use mesh analysis to find the current I_o in the circuit of Fig. 9.

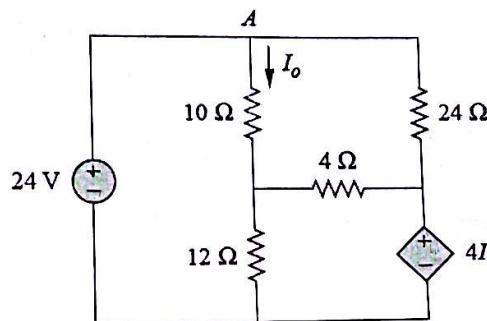


Fig. 9

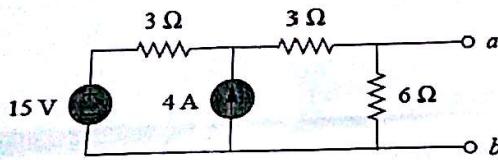


Fig. 10

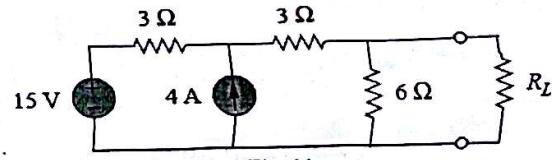


Fig. 11

- (b) Find the Thevenin equivalent circuit at the terminal a-b for the circuit in Fig. 10
 (c) Determine the value of R_L that will draw the maximum power from the rest of the circuit in Fig. 11. Calculate the maximum power.
 (d) Show that the maximum power transfer takes place when the load resistance R_L equals the Thevenin resistance R_{Th} .

Part-B

(Answer any two of the following questions)

4. (a) Determine I_D , V_{D2} and V_0 for the circuit of Fig. 12

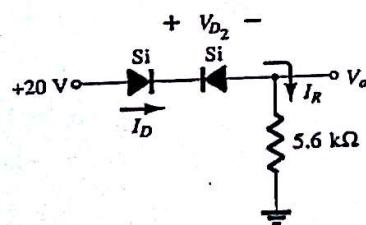


Fig. 12

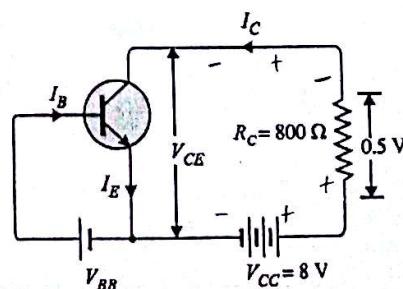


Fig. 13

- (b) A transistor is connected in common emitter (CE) configuration shown in Fig. 13 in which collector supply is 8V and the voltage drop across resistance R_C connected in the collector circuit is 0.5V. The value of R_C is 800 Ω. If $\alpha = 0.96$, determine:
 (i) collector-emitter voltage
 (ii) base current
 (c) Draw the I/O characteristics of CB and CE transistor configuration.
 (d) Differentiate between BJT and FET.

5. (a) For the circuit in Fig. 14:
 i) Find the mathematical expressions for the transient behavior of the voltage v_C and the current i_C if the capacitor was initially uncharged and the switch is thrown into position 1 at $t = 0$ s.

- (i) Find the mathematical expressions for the voltage v_C and the current i_C if the switch is moved to position 2 at $t = 10 \text{ ms}$. (Assume that the leakage resistance of the capacitor is infinite ohms; that is, there is no leakage current.)
 (ii) Find the mathematical expressions for the voltage v_C and the current i_C if the switch is thrown into position 3 at $t = 20 \text{ ms}$.
 (iv) Plot the waveforms obtained in parts (i) to (iii) on the same time axis using the defined polarities in Fig. 14.

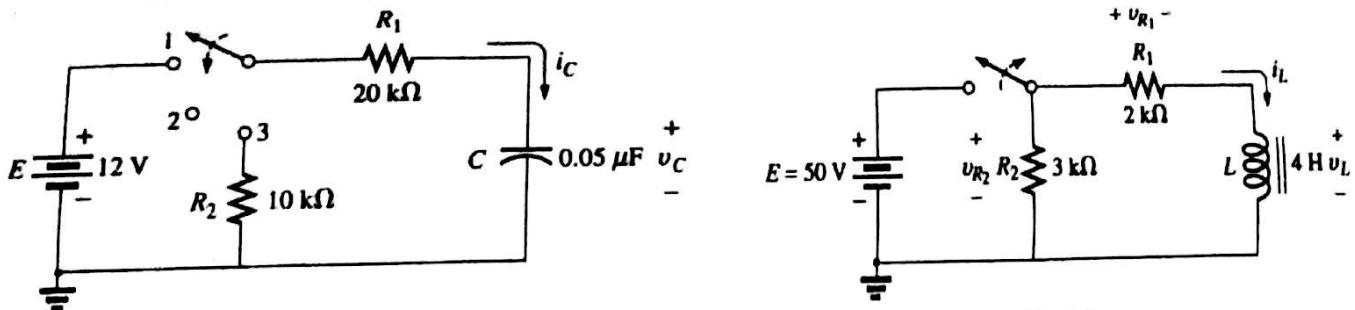


Fig. 14

Fig. 15

10

- (b) For the circuit in Fig. 15:
 i) Find the mathematical expressions for i_L , v_L , v_{R1} and v_{R2} for five time constants of the storage phase.
 ii) Find the mathematical expressions for i_L , v_L , v_{R1} and v_{R2} if the switch is opened after five time constants of the storage phase.
 iii) Sketch the waveforms for each voltage and current for both phases covered by this problem. Use the defined polarities in Fig. 15.

5

- (c) Find currents I_1 and I_2 and voltages V_1 and V_2 for the network in Fig. 16.

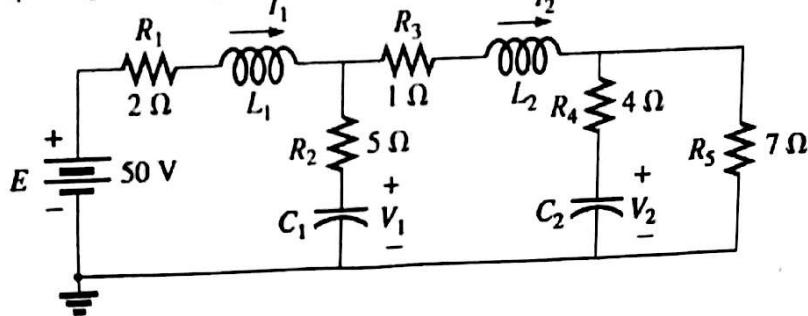


Fig. 16

8

6. (a) Determine the following for the network of Fig. 17

- i) V_{GSQ}
- ii) I_{DQ}
- iii) V_{DS}
- iv) V_D
- v) V_G
- vi) V_S

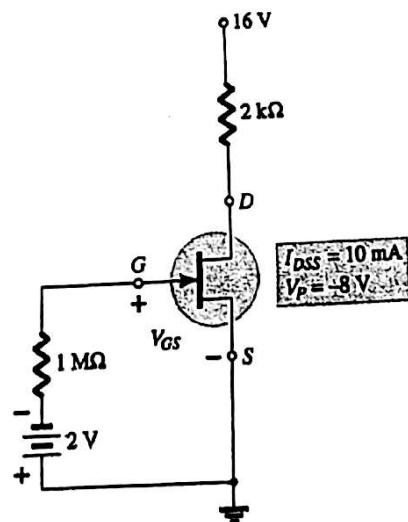


Fig. 17

