SOE.

KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Marks Scored:

Level : B.E./BIT
Year : I

20 MAR 2025

Course : MATH 104
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date :

SECTION "A"
[10 Q. × 1 = 10 marks]

Fill in the blank space(s) by writing the most appropriate word(s) or symbol(s).

1. The Cartesian form of the polar equation $r^2 \sin 2\theta = 2$ is _____.

2. The level curve of $f(x, y) = y - x^2$ at $(1, 1)$ is _____.

3. If $u(x, y) = e^x \sin y$, then $u_{xx} + u_{yy} =$ _____.

4. The area of a closed and bounded region R in polar coordinates plane is given by the double integral _____.

5. The value of $\Gamma\left(\frac{5}{2}\right) =$ _____, where the symbol has its usual meaning.

6. The radius of curvature of the curve, $\vec{r}(t) = (\cos t)\ \vec{i} + (\sin\ t)\ \vec{j}$ is _____.

7. The length of the indicated portion of the curve

   $\vec{r}\ (t) = (2\cos t)\ \vec{i} + (2\sin t)\ \vec{j} + \left(\sqrt{5}\ t\right)\vec{k}\ ,\ 0 \leq t \leq \pi$ is _____.

8. Stoke's theorem is a generalization of Green's theorem in _____ form to three dimensions.

9. The gradient field of the function $f(x, y, z) = xyz$ is _____.

10. A function $f(x)$ is said to be periodic if it is defined for all x, and there is some positive integer T such that _____ for all x.

SECTION "B"

[10 Q.× 1 = 10 marks]

Fill in the blank space(s), **DO NOT TICK**, by selecting the most appropriate answers from among the given ones.

11. The curve $r^2 = 4\sin 2\theta$ is symmetrical about _____.

[$x-$ axis; $y-$ axis; origin; all]

12. The center of the circle $r = 2\sin\theta$ is at _____.

[$(0,0)$; $(1,\ 0)$; $\left(1,-\frac{\pi}{2}\right)$; $\left(1,\ \frac{\pi}{2}\right)$]

13. Tangent plane of the surface $f(x,y,z) = x^2 + y^2 + z$ at $(0,0,0)$ is _____.

[$x + y + z = 0$; $2x + 2y + 1 = 0$; $x + y = 0$; $z = 0$]

14. If $w = x^2 + 2y^3,\ x = \sin t,\ y = \cos t$, then $\frac{dw}{dt}$ at $t = \frac{\pi}{2}$ equals to _____.

[0; -6; 2; 6]

15. The Jacobian of the transformation $x = r\cos\theta,\ y = r\sin\theta$ is _____.

[r; r^2; $r\sin\theta\cos\theta$; $r^2\sin\theta\cos\theta$]

16. Let $\vec{B} = \vec{T} \times \vec{N}$. The torsion function of a smooth curve is $\tau =$ _____.

[$-\frac{d\vec{B}}{ds}.\vec{N}$; $-\frac{d\vec{B}}{ds}\times\vec{N}$; $-\frac{d\vec{N}}{ds}.\vec{B}$; $-\frac{d\vec{N}}{ds}\times\vec{B}$]

17. If the acceleration vector is written as $\vec{a} = a_T\,\vec{T} + a_N\,\vec{N}$, then $a_T =$ _____.

[$\frac{d^2s}{dt^2}$; $\kappa|\vec{v}|^2$; $\left(\frac{ds}{dt}\right)^2$; $\frac{d\vec{v}}{dt}$]

18. If a vector field, $\vec{F}$ is conservative then, $\vec{F}$ = _____, for some scalar function f.

[∇f; $\nabla.\nabla f$; $\nabla\times\nabla f$; f]

19. The formula for the flux of a vector field, $\vec{F}(x,y) = P(x,y)\,\vec{\imath} + Q(x,y)\,\vec{\jmath}$ across a simple closed curve C is _____.

[$\int_C Pdy - Qdx$; $\int_C Pdy + Qdx$; $\int_C Pdx - Qdy$; $\int_C Pdx + Qdy$]

20. The fundamental period of the function $y = \tan 2x$ is _____.

[$\frac{\pi}{4}$; $\frac{\pi}{2}$; π; 2π]

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SECTION "C"
[4 Q. × 7 = 28 marks]

1. Illustrate the standard polar coordinate tests for symmetry. Check the symmetry and sketch the polar curve $r = 2 - 2\cos\theta$. Find the area of the region that lies inside the circle $r = 1$ and outside the cardiod $r = 1 - \cos\theta$. [2+3+2]

2. Explain directional derivative and discuss its properties. Find the derivative of the function $f(x, y) = x^3 - xy^2$ at $P_0(1, 1)$ in the direction of $\vec{v} = 3\vec{\imath} - 4\vec{\jmath}$. In what directions does this function f increase most rapidly and decrease most rapidly? [3+2+2]

3. Define unit tangent vector $(\vec{T})$, principal unit normal vector $(\vec{N})$ and curvature (κ). Find $\vec{T}$, $\vec{N}$, κ and ρ for the space curve $\vec{r}(t) = (3\sin t)\,\vec{\imath} + (3\cos t)\,\vec{\jmath} + 4t\,\vec{k}$, where the symbols have their usual meanings. [3+4]

4. Define conservative vector field and potential function. Verify whether the vector field $\vec{F} = (2xy)\,\vec{\imath} + (x^2 + z)\,\vec{\jmath} + (y)\,\vec{k}$ is conservative. If it is, find the potential function for this vector field. [2+2+3]

OR

Describe flux and divergence of the vector field $\vec{F}(x, y)$. State Green's theorem in tangential form. Verify this form for the field, $\vec{F} = -x^2 y\,\vec{\imath} + xy^2\vec{\jmath}$ and the region R bounded by the circle $\vec{r}(t) = (a\cos t)\,\vec{\imath} + (a\sin t)\,\vec{\jmath}$, $0 \le t \le 2\pi$. [2+1+4]

SECTION "D"
[9Q. × 3 = 27 marks]

5. Find the spherical and cylindrical coordinates of the point whose Cartesian coordinate is $(0, 1, 0)$.

6. Find the partial derivatives $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ in terms of r and s if $w = x + 2y + z^2$, $x = \frac{r}{s}$, $y = r^2 + \ln s$ and $z = 2r$.

OR

Find the limit of the function (if it exists) $f(x, y) = \frac{2x^2y}{x^4+y^2}$ as (x, y) approaches $(0, 0)$. Discuss the continuity of this function at the origin.

P.T.O.

7. Find the greatest and smallest values that the function $f(x, y) = xy$ takes on the ellipse $\frac{x^2}{8} + \frac{y^2}{2} = 1$.

8. State Gamma function and use it to evaluate $\int_0^{\pi/2} \cos^3\theta \sin^4\theta \, d\theta$.

9. Change the Cartesian integral $\int_0^1 \int_0^{\sqrt{1-y^2}} (x^2 + y^2) dx \, dy$ into an equivalent polar integral and then evaluate the polar integral.

OR

Evaluate the integral $\int_0^{2/3} \int_y^{2-2y} (x + 2y) e^{y-x} dx \, dy$ using the transformation

$u = x + 2y, v = x - y$.

10. Evaluate the triple integral, $\int_{-1}^1 \int_0^{2\pi} \int_0^{1+\cos\theta} 4r \, dr \, d\theta \, dz$.

11. Find the velocity, speed, and acceleration of a particle whose motion in space is given by the position vector $\vec{r}(t) = (6\cos t)\ \vec{i} + (6\sin t)\,\vec{j} + 8t\,\vec{k}$ at time t.

12. Evaluate $\int_C (x - 3y^2 + z)\, ds$ over the line segment C joining the origin to the point $(1, 1, 1)$.

13. Find the Fourier series of $f(x) = \begin{cases} -1, & -\pi < x < 0 \\ 1, & 0 < x < \pi \end{cases}$.

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Semester : II

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Registration No.:

Date 25 MAR 2025

SECTION "A"
[15Q. × 1 = 15 marks]

Choose and Mark [X] in the most appropriate answer.

1. If the divergence of a vector function is zero, then the vector function can be expressed as
   [ ] the divergence of some other vector function.
   [ ] the curl of some other vector function.
   [ ] the gradient of other vector function.
   [ ] the gradient of a scalar function.

2. A hollow metallic sphere of radius 0.1 m has 10^{-8} C of charge uniformly spread over it. The electric field intensity (in N/C) at point 7 cm away from the center is
   [ ] $\frac{90}{7^2}$ [ ] $\frac{90}{(0.07)^2}$ [ ] zero [ ] $\frac{90}{0.07}$

3. A charge q is located at the center of a cube. The electric flux through any face is
   [ ] $\frac{1}{4\pi\varepsilon_0}\frac{\pi q}{6}$ [ ] $\frac{1}{4\pi\varepsilon_0}\frac{4\pi q}{6}$ [ ] $\frac{1}{4\pi\varepsilon_0}\frac{q}{6}$ [ ] $\frac{1}{4\pi\varepsilon_0}\frac{q}{6\varepsilon_0}$

4. The electrostatic potential energy of configuration of four charges +q, -2q, -q and +2q placed at four corners A, B, C and D of a square of side 'a' is
   [ ] $-\frac{1}{4\pi\varepsilon_0}\left[\frac{5q^2}{a\sqrt{2}}\right]$ [ ] $-\frac{1}{4\pi\varepsilon_0}\left[\frac{5q^2}{2a^2}\right]$
   [ ] $-\frac{1}{4\pi\varepsilon_0}\left[-\frac{5q^2}{a\sqrt{2}}\right]$ [ ] $\frac{1}{4\pi\varepsilon_0}\left[\frac{5q^2}{2a^2}\right]$

5. When does a magnetic dipole possess maximum potential energy inside a magnetic field?
   [ ] Magnetic moment and magnetic field are antiparallel
   [ ] Magnetic moment and magnetic field are parallel
   [ ] The magnetic moment is zero
   [ ] The magnetic field is zero

6. Suppose that the magnetic field points in the y-direction, and the electric field in the z-direction. A charged particle is released from the origin. The path followed by the particle is
   [ ] a circle on xy-plane [ ] a cycloid on xz-plane
   [ ] a cycloid on yz-plane [ ] a cycloid on xy-plane.

7. What is the magnitude of the magnetic field at point P if $a = R$ and $b = 2R$?

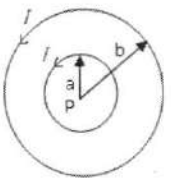

Figure A.1

[ ] $\frac{3\mu_0 I}{4R}$ [ ] $\frac{\mu_0 I}{4R}$ [ ] $\frac{2\mu_0 I}{4R}$ [ ] $\frac{3\mu_0 I}{4\pi R}$

8. The retentivity in ferromagnetic substance is
[ ] the area of the hysteresis loop
[ ] the state of magnetic saturation
[ ] the magnetic field required to cancel out the magnetization
[ ] the magnetization left even after the removal of magnetizing field

9. The direction of induced emf is given by
[ ] Fleming's left hand rule. [ ] Fleming's right hand rule.
[ ] Lenz's law. [ ] Biot- Savart law.

10. The electron emitted in β – radiation originates from _____
[ ] Inner orbits of atoms
[ ] Free electrons existing in nuclei
[ ] The decay of a neutron in nuclei
[ ] Photon escaping from the nucleus

Fill in the blanks.

11. If the current changes from 5A to 3A in 2 seconds and the inductance is 10H, then induced emf is_____.

12. The dimension of $\frac{1}{\mu_o \epsilon_o}$ is_____.

13. A solenoid of length 0.5 m has a radius of 3 cm and is made up of 1000 turns. If it carries current of 2 A, then the magnitude of the magnetic field outside the solenoid is_____.

14. The half-life of radon is 3.8 days. After how many days will only $\frac{1}{20}$ of a radon sample be left over_____.

15. Lead has a superconducting transition temperature of 7.26 K. If initial field at 0 K is 50 $\times 10^3$ Am^{-1}, then the critical field at 6 K is_____.

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F. M. : 40

SECTION "B"
[5Q × 3 = 15 marks]

Attempt ALL questions.

1. Show that $\overrightarrow{F_1} = yz\,\hat{\imath} + zx\,\hat{\jmath} + xy\,\hat{k}$ can be written both as the gradient of a scalar and as the curl of a vector.

OR

Show that curl of electric field due to stationary charge is always zero.

2. Define polarization? Show that volume bound charge density, $\rho_b = \nabla.\vec{P}$

OR

Obtain an expression for potential energy of the configuration of three charges and generalize the result for a system of n point charges.

3. What is atomic polarizability? Derive the Clausius-Mossotti equation.

4. Find the energy stored (over all space) in a uniformly charged solid sphere of radius R and total charge q.

5. A short solenoid (length l and radius a, with n_1 turns per unit length) lies on the axis of a very long solenoid (radius b, n_2 turns per unit length) as shown in (Fig. B.1). Current I flows in the short solenoid. What is the flux through the long solenoid? What is the mutual induction?

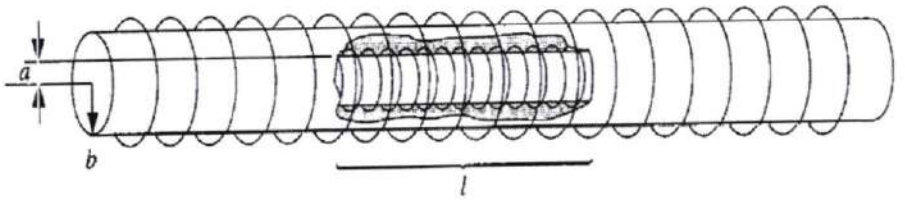

Figure B.1

P.T.O.

SECTION "C"

[5Q × 5 = 25 marks]

Attempt ALL questions.

6. What is electric dipole? Find the electric potential and field at any point due to the short dipole of dipole moment $\vec{p}$.

OR

State Faraday's laws of electromagnetic induction. Obtain the flux rule for motional emf and show that $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$

7. Define Q-value of a nuclear reaction. Derive an expression for the Q-value of the nuclear reaction $x + X \rightarrow Y + y$ in terms of kinetic energies of the incident and product particles and masses of the various particles and nuclei. Assume the target nucleus to be at rest in the laboratory. Mention the case when the product particle emerges at right angles to the incident direction.

OR

What is superconductivity? Define and explain the Meissner effect in superconductors. Also, describe the effect of magnetic field on superconductors.

8. Find the magnetic vector potential of a finite segment of a straight wire carrying a current I. Also calculate the magnetic field associated with this potential.

9. Find the electric field a distance z above one end of a straight-line segment of length L that carries a uniform line charge λ. Check that your formula is consistent with what you expect for the case z >> L.

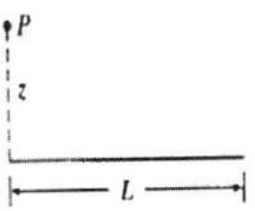

Figure C.1

10. Show that energy density stored in a magnetic field $\vec{B}$ is given by $U_B = \frac{1}{2\mu_0} B^2$.

OR

Explain how Maxwell fixed up Ampere's law. Derive the wave equation for $\vec{E}$ and $\vec{B}$ for electromagnetic waves in vacuum.

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SECTION "A"
[20Q. × 0.5= 10 marks]

Choose and mark [X] in the most appropriate option from each set of choices

1. Which of the following components is NOT part of the microprocessor?
   [ ] Register [ ] Control Unit [ ] ALU [ ] Clock Generator

2. Which register holds the memory address of the next instruction to be executed?
   [ ] Program Counter [ ] Instruction Register
   [ ] Stack Pointer [ ] Accumulator

3. The width of the data bus in a microprocessor determines:
   [ ] The speed of instruction execution [ ] The number of bits processed simultaneously
   [ ] The size of addressable memory [ ] The number of instructions in the instruction set

4. Which of the following is NOT a valid addressing mode in assembly language?
   [ ] Immediate [ ] Indirect [ ] Random [ ] Direct

5. Which assembly instruction is used to branch to a label if the Zero Flag is set?
   [ ] JMP [ ] JNZ [ ] JZ [ ] JP

6. Consider the following code, What does the code compute?
   LXI H, 2500H
   MOV A, M
   INX H
   MOV B, M
   ADD B
   [ ] Sum of the contents of memory locations 2500H and 2501H
   [ ] Difference between the contents of memory locations 2500H and 2501H
   [ ] Logical AND of the contents of memory locations 2500H and 2501H
   [ ] Moves data between the two locations

7. If the accumulator contains F0H, what will be its content after executing the instruction RLC?
   [ ] E1H [ ] F1H [ ] 01H [ ] 81H

8. In 8086 assembly language, which register is commonly used as the stack pointer?
   [ ] AX [ ] BP [ ] SP [ ] DX

9. Which of the following is the purpose of an assembler in 8086 assembly language programming?
   [ ] To convert assembly language code into machine code
   [ ] To execute machine code directly
   [ ] To provide debugging tools for assembly language code
   [ ] To generate the source code for high-level programming languages

10. Which of the following 8086 instructions is used to perform a conditional jump based on the comparison of two operands?
[ ] JMP [ ] JE [ ] JC [ ] LOOP

11. Which 8086 instruction is used to transfer data from a 16-bit register to a memory location?
[ ] MOV [ ] SHL [ ] POP [ ] ADD

12. Which of the following is true about the "DB" directive in 8086 assembly language?
[ ] It defines a byte of data and initializes it with a given value
[ ] It defines a word of data
[ ] It defines a segment of memory for data storage
[ ] It is used to declare a label

13. Which register in the 8086 microprocessor is used to hold the offset address for code segment?
[ ] AX [ ] BX [ ] IP [ ] SP

14. In the 8086 microprocessor, what is the function of the "INT" instruction?
[ ] To perform an interrupt operation
[ ] To transfer data from one register to another
[ ] To jump to a specific address
[ ] To enable a hardware interrupt

15. Which of the following pins in the 8086 microprocessor are used for address bus multiplexing?
[ ] A15-A0 [ ] AD15-AD0 [ ] S0-S7 [ ] T1-T4

16. In the microprocessor, address decoding is used to:
[ ] Convert machine code into assembly language
[ ] Determine the specific memory or I/O device to access based on the address provided by the microprocessor
[ ] Set the flags for arithmetic operations
[ ] Fetch the instruction from the memory

17. What is the effect of the instruction CMP AX, BX in 8086?
[ ] Compares the values in AX and BX and stores the result in AX.
[ ] Compares the values in AX and BX and sets the condition flags based on the result.
[ ] Moves the value of AX into BX.
[ ] Performs a subtraction of AX and BX and stores the result in AX.

18. Which of the following instructions will NOT affect the flags in the 8086?
[ ] ADD [ ] SUB [ ] MOV [ ] CMP

19. In 8237 DMA Controller, if each device connected to a channel is assigned to a fixed priority then it is said to be in _____.
[ ] Rotating Priority Scheme
[ ] Fixed Priority Scheme
[ ] Rotating Priority and Fixed Priority Scheme
[ ] Interrupt Stage

20. Which of the following is the correct sequence of interrupt priority in the 8085 microprocessor (from highest to lowest)?
[ ] TRAP, RST7.5, RST6.5, RST5.5 [ ] RST5.5, RST6.5, TRAP, RST7.5
[ ] TRAP, RST5.5, RST6.5, RST7.5 [ ] RST6.5, TRAP, RST7.5, RST5.5

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Date 01 Apr 2025

SECTION "A"
[20Q. × 0.5= 10 marks]

Choose and encircle the most appropriate option from each set of choices

1. Which type of inheritance allows a class to inherit from multiple base classes?
   a. Single inheritance
   b. Multilevel inheritance
   c. Multiple inheritance
   d. Hierarchical inheritance

2. What is the correct syntax to inherit a class Derived from a base class Base in C++?
   a. class Derived inherits Base {};
   b. class Derived : public Base {};
   c. class Derived extends Base {};
   d. class Derived :: Base {};

3. Which access specifier restricts inherited members from being accessed outside the derived class?
   a. public
   b. private
   c. protected
   d. friend

4. What happens if a derived class does not override a pure virtual function from the base class?
   a. It results in a compilation error.
   b. The program crashes.
   c. The base class function is called.
   d. The derived class becomes abstract.

5. When is a destructor automatically called in C++?
   a. When an object is explicitly deleted using delete
   b. When an object goes out of scope or is explicitly deleted
   c. When a program starts execution
   d. When the free() function is used

6. Which of the following is true about constructor calls in inheritance?
   a. Only the derived class constructor is called.
   b. The base class constructor is called before the derived class constructor.
   c. The derived class constructor is called before the base class constructor.
   d. Constructors are not called in inheritance.

7. What is the output of the following code?

```
#include <iostream>
using namespace std;
class Base {
public:
    virtual void show(int x = 10) {
        cout << "Base: " << x << endl;}};
class Derived : public Base {
public:
    void show(int x = 20) override {
        cout << "Derived: " << x << endl;}};
int main() {
  Base* b = new Derived(); b->show(); delete b; return 0;}
```

   a. Base: 10
   b. Derived: 20
   c. Derived: 10
   d. Compilation error

8. Which OOP feature is demonstrated by making data members private and providing public getter/setter methods?
a. Inheritance b. Polymorphism c. Abstraction d. Encapsulation

9. What is the primary purpose of an abstract class in OOP?
a. To instantiate objects directly.
b. To provide a base class with at least one pure virtual function (= 0).
c. To allow multiple inheritance.
d. To optimize memory usage.

10. Which principle allows a function to behave differently based on the object type it is called upon?
a. Encapsulation b. Polymorphism c. Inheritance d. Abstraction

11. Which of the following is true about static member functions in C++?
a. They can access non-static data members directly
b. They can be called without an object of the class
c. They can use the this pointer
d. They can be declared as virtual

12. Where should default arguments be specified in a function parameter list?
a. Anywhere in the parameter list
b. Only at the beginning of the parameter list
c. Only at the end of the parameter list
d. Default arguments are not allowed in C++

13. What is the primary advantage of using an inline function in C++?
a. Reduces memory usage
b. Increases execution speed by avoiding function call overhead
c. Increases the size of the executable significantly
d. Allows runtime modification of function behavior

14. Which of the following is true about reference variables in C++?
a. A reference variable can be reassigned to refer to another variable
b. A reference variable must always be initialized when declared
c. A reference variable occupies separate memory from the original variable
d. A reference variable can be NULL

15. Which of the following operators cannot be overloaded in C++?
a. + (Addition) b. = (Assignment) c. [] (Subscript) d. :: (Scope resolution)

16. Which operator is typically overloaded as a non-member function?
a. = (Assignment) b. () (Function call)
c. << (Stream insertion) d. [] (Subscript)

17. Which syntax correctly defines a class template in C++?
a. class MyClass<T> template { }; b. template (class T) class MyClass { };
c. class template <T> MyClass { }; d. template <class T> class MyClass { };

18. What is the purpose of a function template in C++?
    a. To allow a function to operate with different data types using a single definition
    b. To improve the runtime performance of a function
    c. To restrict a function to work only with integer types
    d. To automatically generate multiple function definitions at runtime

19. What is the purpose of the try block in exception handling?
    a. To declare an exception
    b. To define the handling mechanism for an exception
    c. To contain the code that might throw an exception
    d. To catch the thrown exception

20. Which of the following is the correct syntax to catch all exceptions?
    a. catch(Exception e)
    b. catch(*)
    c. catch(...) { throw; }
    d. catch(...)

KATHMANDU UNIVERSITY
End Semester Examination
March/April 2025

Level : B.E./BIT
Year : I
Time : 2 hrs. 30 mins.

01 APR 2025

Course : COMP 116
Semester : II
F. M. : 40

SECTION "B"
[6 Q × 4 = 24 marks]

Attempt ***ANY SIX*** questions.

1. What is a reference variable in C++? How is it different from a pointer? Write a C++ program to swap two numbers using reference variables. [1+1+2]

2. List and explain four key features of Object-Oriented Programming in C++. How do these features improve software development compared to procedural programming? [2+2]

3. Why can a static member function only access static data members? Write a C++ program to demonstrate a class with a static data member and a static member function that displays the total count of objects created. [1+3]

4. What is a virtual base class in C++? How does it help in resolving the diamond problem in multiple inheritance? Write a C++ program to demonstrate the use of a virtual base class with a Person base class and derived classes Student and Teacher.(with necessary assumptions) [1+1+2]

5. How do access specifiers affect inheritance in C++? Explain how public, private, and protected inheritance modify the accessibility of base class members in a derived class.

6. What is exception handling in C++? Explain the purpose of try, catch, and throw with an example program that handles array bound out of size using exception handling. [1+3]

7. You are given a class Complex that represents complex numbers. Overload the + operator to add two complex numbers. The Complex class should have two private data members: real and imaginary, representing the real and imaginary parts of the complex number. Write the necessary operator overloading function to perform the addition of two complex numbers.

SECTION "C"
[2 Q × 8 = 16 marks]

Attempt ***ANY TWO*** questions.

8. Write in brief about the new delete operator and its significance in constructor and destructor. Discuss in brief significance of operator overloading using friend function with appropriate example. [4+4]

9. Write a class template having an array as a data member and two member functions which sort and return maximum value stored in the array. [8]

10. How does dynamic binding work in C++? What role do base class pointers play in achieving runtime polymorphism? Write a C++ program that demonstrates runtime polymorphism by using a base class pointer to call overridden functions in derived classes. Show how the correct function is called at runtime based on the actual object type. [2+2+4]

KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Marks Scored:

Level : B.E.
Year : I
Course : ENVE 101
Semester : II
Exam Roll No. :
Time: 30 mins.
F. M. : 20
Registration No.:
Date : 04 APR 2025

SECTION "A"
[20 Q. × 1 = 20 marks]

Choose and encircle the most appropriate option.

1. Which unit is **NOT** used to measure the concentration of dissolved solids in water?
   a. mg/L b. kg/m^3 c. ppm d. kg/day

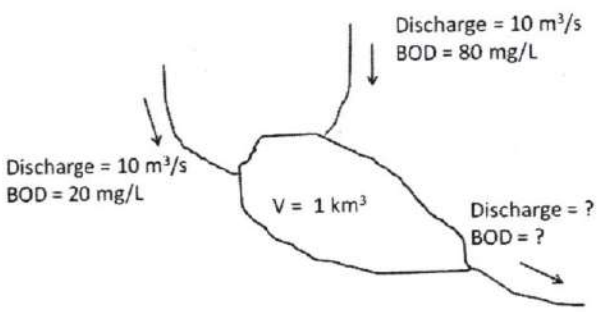
2. What does Hydraulic Retention Time (HRT) in water or wastewater treatment indicate?
   a. Total energy required for treatment
   b. Maximum flow rate of wastewater
   c. Average time water spends in a treatment unit
   d. Efficiency of sedimentation tanks

3. Which of the following is **NOT** an environmental study level as per Nepal's Environmental Protection Rules (EPR)?
   a. Brief Environmental Study (BES)
   b. Initial Environmental Examination (IEE)
   c. Environmental Impact Assessment (EIA)
   d. Advanced Environmental Study (AES)

4. Which hydrological process is responsible for replenishing groundwater reserves?
   a. Evaporation b. Infiltration c. Runoff d. Condensation

5. The annual runoff from the catchment of 2000 ha if the annual precipitation is 1400 mm and annual evapotranspiration is 800 mm is _____ m^3.
   a. 12×10^6 b. 1.2×10^6 c. 44×10^6 d. 4.4×10^6

6. The BOD in the lake output in the figure shown below is:
   a. 50 mg/L b. 5 mg/L c. 60 mg/L d. 100 mg/L



7. What is the main function of a purge stream in a chemical process?
   a. To maintain the reaction temperature
   b. To remove unreacted residue and prevent accumulation
   c. To reduce the reaction pressure
   d. To increase the concentration of reactants

8. In water treatment, _____ is used to kill harmful microorganisms before distribution.
   a. Filtration b. Aeration c. Chlorination d. Screening

9. The estimated arithmetic populations of a city after 20 years will be_____ if average population growth is 10,350 and the population of the base year is 74100.
   a. 84,450 b. 95,000 c. 138,000 d. 74,100

10. Which of the following gives decreasing order of sewer size (in terms of diameter)?
   a. House>Laterals>Mains>Outfall b. Outfall > Mains > Laterals >House
   c. House >Laterals >Outfall>Mains d. Outfall>Laterals>Mains>House

11. A city's wastewater treatment plant processes 10,000 m^3 of wastewater per day. If the concentration of suspended solids is 100 mg/L, how much total solids do the plant process each day?
   a. 500 kg b. 10 kg c. 100 kg d. 1000 kg

12. Which of the following is a biological wastewater treatment process?
   a. Coagulation b. Sedimentation
   c. Activated Sludge Process d. Filtration

13. According to Monod kinetics in wastewater treatment, what happens when substrate concentration (S) is very high?
   a. Microbial growth rate remains constant
   b. Microbial growth rate decreases
   c. Microbial growth rate reaches maximum
   d. Microbial growth rate stops completely

14. What does the Air Quality Index (AQI) measure?
   a. The total volume of air pollutants
   b. The cleanliness or pollution levels in the air
   c. The effects of air pollution on ecosystems
   d. The concentration of oxygen in the atmosphere

15. Which of the following is **NOT** considered one of the six "criteria" air pollutants?
   a. Carbon monoxide
   b. Lead
   c. Hydrogen peroxide
   d. Sulfur oxides

16. What is the purpose of an electrostatic precipitator (ESP)?
   a. To filter out coarse dust particles
   b. To remove fine particulate matter from air
   c. To regulate carbon monoxide emissions
   d. To neutralize sulfur oxides in the air

17. The sound power level results from combining the 65 dB, 60 dB, and 70 dB is _____.
a. 72 b. 75 c. 70 d. 65

18. The solid waste generated from city of 25,000 people at the rate of 2 kg/capita/day is forwarded to a landfill of an area 50 m^2. If the daily waste covers 4 m depth of the landfill, the typical density of solid waste is _____ kg/m^3.
a. 500 b. 250 c. 2000 d.5000

19. A Functional Unit is _____.
a. A quantified description of the performance of the product systems.
b. Description of material and energy flows.
c. Critical balance of supplies.
d. Defines how big a part of product life cycle will be.

20. Which of the following is **NOT** the product life cycle phase?
a. Raw material extraction b. Manufacture and use
c. Inventory d. End of life

KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Level : B.E.
Year : I
Time : 2 hrs. 30 mins.

04 APR 2025

Course : ENVE 101
Semester : II
F. M. : 55

SECTION "B"
[4 Q. × 4 = 16 marks]

Attempt *ALL* questions. Make a logical assumption wherever required.

1. A river during the dry season has a sediment load of up to 1500 mg/L. 75% Water from this river is channeled through a pump station and delivered to a water treatment facility. The flow rate at the pump station is 30 liters per second (lps).
   a. Draw the schematic diagram of the system. [1]
   b. Calculate the mass flow rate of sediment entering the treatment facility. [2]
   c. If the treatment facility is capable of removing 85% of the suspended solids, determine the concentration of sediments in the treated water (effluent). [1]

2. An electrostatic precipitator with an area of collector plate 6000 m^2 is 97 percent efficient in treating 200 m^3/s of flue gas from a power plant. The owner of the power plant decides to achieve incremental improvements in the collection efficiency of the collector plate but there is only 0.1 ha of land remaining inside the power plant boundary. The owner needs to confirm weather is it feasible to increase the 99 percent or he has to limit the increment in 98 percent. Determine the area of collector plate for the both cases? Use three digits after decimal.

3. Explain the physical and chemical properties of solid waste?

OR

Describe the Properties of Hazardous waste.

4. Briefly explain the concept of Life Cycle Assessment (LCA). What are its key stages, and how does it help in minimizing environmental impact and improving resource efficiency?

SECTION "C"
[4 Q. × 6 = 24 marks]

5.
   a. What is hydrological cycle and what are its key processes? Describe briefly. [3]
   b. A city is experiencing water shortages despite receiving adequate rainfall annually. In this scenario, analyze the role of different hydrological cycle processes that might be affecting water availability. Also, Suggest engineering solutions to improve water conservation and sustainable water management in the city. [3]

P.T.O.

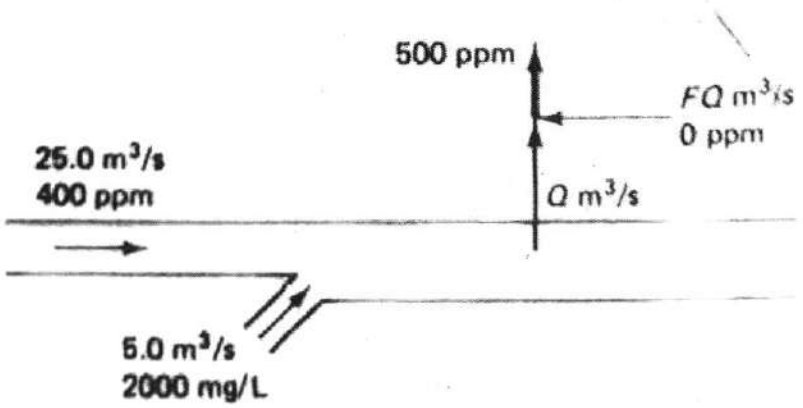
6. Determine combined discharge from the following data:

Area to be served	= 6, 00,000 sq. m.
Population density	= 1084 per ha.
Time of entry	= 5 min
Time of flow	= 18 min
Rate of water supply	= 170 lpcd
Permeability	= 50%
Peak factor	= 3

Time of concentration= Sum of time of entry and time of flow.

Also, calculate the cross sectional area of circular sewer if velocity of flow is 1.5 m/s and the diameter of sewer.

7. A river with 400 ppm of salts (a conservative substance) and an upstream flow of 25 m^3/s receives an agricultural discharge of 5 m^3/s carrying 2000 mg/L of salts. The salts quickly become uniformly distributed in the river. A municipality just downstream withdraws water and mixes it with enough pure water (no salt) from another source to deliver water having no more than 50 ppm salts to its customers.



What should be the mixture ratio F of pure water to river water?

8. Explain the significance of different water quality parameters (physical, chemical, and biological) in ensuring safe drinking water. Explain how do these parameters influence the design and operation of a water treatment plant?

OR

Discuss the role of microbial kinetics in wastewater treatment. Explain the Monod equation and its importance in predicting bacterial growth and substrate utilization in biological treatment processes

SECTION "D"
[15 marks]

9. Differentiate between ***ANY THREE*** of the following. [2+2+2=6]
   a. Mass Extensive and Mass Intensive system
   b. Cyclone and Electrostatic Precipitator
   c. Arithmetical and Geometric increase method for population forecast
   d. Alley Collection system and Set-Out Collection system

10. Write Short Notes on ***ANY THREE*** of the following. [3×3=9]
   a. Control of Noise Pollution
   b. Criteria Pollutants
   c. Transfer Station
   d. Two Principles of Green Engineering

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2025

Marks Scored:

Level : B.E.
Year : I
Exam Roll No. :

Time: 30 mins.

Course : ENGT 105
Semester : I/II
F. M. : 10

08 APR 2025

Registration No.:

Date :

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Circle the most appropriate answer from each set of choice.

1. Vasili Svietlovidoff feels abandoned and disillusioned because he... (Swan Song)
   a. lost all his wealth.
   b. was betrayed by his colleages.
   c. realizes that fame and applause are fleeting.
   d. never became a successful actor.

2. Albert Camus concludes that "Sisyphus must be imagined happy"... (The Myth of Sisyphus)
   a. Because he is unaware of his suffering
   b. Because accepting his fate gives him freedom
   c. Because the gods eventually forgive him
   d. Because he enjoys the physical labor

3. The prisoners in the cave represent as… (The Allegory of the Cave)
   a. People who are enlightened
   b. Politicians controlling society
   c. Gods watching over humans
   d. Individuals who are ignorant of true reality

4. What does Freud say about the possibility of completely eliminating war? (Letter to Einstein)
   a. It is impossible due to human nature
   b. It will happen within a few generations
   c. It depends on technological advancements
   d. It is only achievable through religious conversion

5. The speaker describes the two roads initially as... (The Road Not Taken)
   a. One is more overgrown than the other
   b. They are nearly the same
   c. One is clearly the better choice
   d. Both are dangerous and difficult

6. According to Huxley, what is a key characteristic of a scientific mind? (We Are All Scientists)
   a. The ability to memorize facts
   b. The ability to work in a laboratory
   c. The rejection of all non-scientific beliefs
   d. The willingness to question assumptions and seek evidence

7. V.S. Ramachandran views about interdisciplinary thinking in science...
(The Making of Scientist)
   a. leads to major breakthroughs
   b. is unnecessary for scientific progress
   c. makes scientific work more difficult
   d. is only useful for advanced researchers

8. Carl Sagan describes the danger of excessive skepticism as it…
(The Burden of Skepticism)
   a. can lead to a rejection of all new ideas, including valid ones.
   b. strengthens scientific discoveries.
   c. encourages open-mindedness.
   d. eliminates false beliefs.

9. What should be included in the Appendices section of a project proposal?
   a. The project's legal documentation
   b. Additional supporting materials, charts, and data
   c. A summary of the conclusion
   d. An executive summary of the proposal

10. Which of the following is NOT a typical component of a concept paper?
   a. Project Timeline
   b. Objectives
   c. Detailed technical drawings
   d. Budget Estimate

11. Which of the following is the correct format for citing the book Palpasa Café by Narayan Wagle in APA style?
   a. Wagle, N. *Palpasa Café.* Nepal Publishing House. (2005).
   b. Wagle, N. (2005). *Palpasa Café*. Kathmandu: Nepal Publishing House.
   c. Wagle, N. (2005). *Palpasa Café*. Nepal.
   d. Wagle, N. (2005). *Palpasa Café*. Nepal Publishing House.

12. The Presenter should start an oral presentation to grab attention by ...
   a. reading from the script
   b. stating a personal opinion
   c. asking a thought-provoking question or telling a relevant story
   d. listing the main points of the presentation

13. The purpose of the "cc" (carbon copy) serves in email correspondence is to...
   a. send a private copy to the sender.
   b. highlight a section of the email.
   c. send the same email to multiple readers.
   d. send the email to a secondary recipient.

14. The role of the "Executive Summary" or "Abstract" in a project report is to...
   a. summarize the findings of the report in one or two paragraphs.
   b. discuss the methodology in detail.
   c. describe the appendices.
   d. present the budget breakdown.

15. Which of the following is an example of inductive reasoning in a Nepali agricultural report?
    a. All farmers in the Terai use chemical fertilizers, so all farmers in Nepal must use them.
    b. Based on observation, farmers in the Terai use chemical fertilizers, and this leads to higher crop yields.
    c. It is proven that using chemical fertilizers guarantees better yields in all regions.
    d. All farmers in the world use chemical fertilizers.

16. In the context of an argument about women's participation in the Nepali workforce, which would be the warrant?
    a. Equal opportunities in the workforce will benefit Nepal's economy.
    b. Women's participation in the workforce will increase economic growth.
    c. The Nepali workforce needs more women to drive economic development.
    d. Women in Nepal are underrepresented in professional fields.

17. Which of these best describes an audience in the "lay" category for technical communication?
    a. Stakeholders interested in general updates and summaries
    b. Experts with in-depth knowledge of the technical field
    c. Individuals with little or no technical knowledge of the subject
    d. Managers looking for decision-making tools based on data

18. Which of the following is a key activity in the pre-writing stage of technical communication?
    a. Drafting the document
    b. Revising for tone and clarity
    c. Identifying the document's purpose, goals and audience
    d. Proofreading the final version

19. Which of the following techniques enhances clarity in technical writing?
    a. Avoiding paragraph breaks
    b. Including long and complex sentences
    c. Using unnecessary abbreviations
    d. Using simple and precise language

20. White space enhances document design by...
    a. making the document look empty
    b. making the document appear less professional
    c. reducing the amount of text that can be included
    d. increasing readability and separating sections clearly

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2025

Level : B.E.
Year : I
Time : 2 hrs. 30 mins.

08 APR 2025

Course : ENGT 105
Semester : I/II
F. M. : 40

SECTION "B"
[8 Q. × 5 = 40 marks]

*Answer **ANY EIGHT** questions diligently. You are expected to treat each answer as a formal document.*

1. Prepare a resume for the following candidate:

> A dedicated and results-driven Mining Engineer with 5 years of experience in Mining In Nepal, specializing in [key skills, e.g., mining engineering, project management, safety compliance]; Got graduate two degrees, one from Nepal and other from abroad. Skilled in utilizing [specific tools, software, or technologies] to enhance operational efficiency and ensure sustainable practices. Proven ability to analyze complex problems develops innovative solutions, and lead teams in high-pressure environments. Strong knowledge of [industry-specific regulations, standards, or procedures], with a commitment to workplace safety and environmental responsibility. Excellent communication and leadership skills, enabling effective collaboration with multidisciplinary teams and stakeholders. Seeking to leverage expertise to contribute to [company/industry goals] while driving innovation and efficiency in the field.

2. Develop a **Concept Paper** on ONE of the following subjects. Make sure to specify a research problem/question.
   a. Sustainable Practices in Mine Waste Management in KU Mining Project
   b. Automation and AI in Underground Mining Operations in KU Mining Project

3. You are one of a supervisor of the Engineering Project. Write a **MEMO** to your head of the department requesting him for providing the project materials and postponing the final proposal defense only after the end semester examination

4. Develop the **Project Description** section of a formal proposal based on ONE of the following subjects.
   a. **Sustainable Mining Practices**: Reducing Environmental Impact: Focus on methods like green mining, eco-friendly equipment, and waste management. Discuss how sustainability can be integrated into mining operations.
   b. **Water Resource Management in Mining Industry:** Discuss water usage in mining, challenges in maintaining water resources, and innovations like water recycling and treatment in mining operations.

P.T.O.

5. Prepare a topic outline of **Long Report** and write what is written in each component with examples.
[Note: for instance, Appendix section includes any additional information (survey results, tables, figures, previous report findings, relevant letters and Memos, etc.) that you have not built into your long report's main text]

6. Prepare a model of at least eight **power point slides** for oral presentation discussing the importance and process of "Document Design in Technical Communication"

7. Both texts explore the theme of choices—Frost's speaker faces a literal crossroads, while Chekhov's protagonist reflects on past decisions. How does each work depict the consequences of choice, and do they suggest that regret is an inevitable part of life?

8. Both Camus and Plato explore the struggle between ignorance and enlightenment. How does Sisyphus' endless labor compare to the prisoners in Plato's cave? Can we view human existence as a cycle of escaping one illusion only to face another?

9. V. S. Ramachandran blends neuroscience with philosophy in his work. How does his interdisciplinary approach influence the way we perceive scientific truth, and what are the potential drawbacks of such a method?

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2025

Marks Scored:

Level : BIT
Year : I

Course : COMP 302
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

08 APR 2025

Registration No.:

Date :

SECTION "A"
[20Q. × 0.5= 10 marks]

Choose and encircle the most appropriate option from each set of choices

1. Which of the following is the primary purpose of System Analysis?
   a. To implement the system
   b. To identify and understand user needs
   c. To design the system's user interface
   d. To test the system after development

2. Which model is a sequential design process that proceeds through stages like requirement analysis, design, implementation, testing, and maintenance?
   a. Waterfall model b. Agile model c. Spiral model d. V-Model

3. What is a primary purpose of a "Feasibility Study" in System Analysis?
   a. To gather user requirements
   b. To decide if the system is technically and financially viable
   c. To test the developed system
   d. To define project timelines

4. What is the main role of a System Analyst in the SDLC?
   a. To write the code
   b. To analyze, design, and document system requirements
   c. To manage the project budget
   d. To test the system

5. A Use Case Diagram is used to show:
   a. How data flows through a system
   b. The behavior of a system from the user's perspective
   c. The system's architecture
   d. The system's physical design

6. What is the primary goal of database normalization?
   a. To improve data redundancy
   b. To organize data in a way that reduces redundancy and improves data integrity
   c. To increase data storage space
   d. To decrease system performance

7. What is the first normal form (1NF) concerned with in database design?
   a. Eliminating partial dependencies
   b. Ensuring that each column contains atomic values
   c. Removing transitive dependencies
   d. Eliminating data redundancy

8. Which of the following is a characteristic of a "Prototyping" model?
   a. It involves creating a complete system in one go
   b. It involves repeated user feedback and system iterations
   c. It follows a strict sequence of stages
   d. It is less time-consuming than other models

9. Which of the following diagrams represents the interactions between users and the system?
   a. Context Diagram
   b. Entity-Relationship Diagram
   c. Data Flow Diagram
   d. Use Case Diagram

10. What does "3NF" (Third Normal Form) focus on in database design?
   a. Eliminating transitive dependencies
   b. Ensuring that every table has a primary key
   c. Ensuring data redundancy
   d. Organizing data into separate tables with foreign keys

11. Which of the following is a primary benefit of creating a system prototype?
   a. Clear and detailed documentation of requirements
   b. Early user feedback to improve system design
   c. Reduced development time
   d. It removes the need for system testing

12. Which diagram is used to represent data entities and their relationships in a system?
   a. Data Flow Diagram
   b. Entity-Relationship Diagram
   c. Use Case Diagram
   d. Sequence Diagram

13. In a Data Flow Diagram, what does a "process" represent?
   a. A data store
   b. An external entity
   c. A transformation of data
   d. A flow of data between entities

14. Which phase of the SDLC involves converting the system design into the actual system?
   a. Analysis b. Design c. Implementation d. Testing

15. What is the role of "End-User" involvement in the system design process?
   a. To gather user requirements and test the system
   b. To write code for the system
   c. To provide detailed system documentation
   d. To manage project budgets

16. Which type of diagram is used to show the flow of messages between objects in the system?
   a. Sequence Diagram
   b. Use Case Diagram
   c. Entity-Relationship Diagram
   d. Class Diagram

17. What does the "Entity" represent in an Entity-Relationship Diagram?
   a. A process
   b. A data flow
   c. A physical object or concept about which information is stored
   d. A user interaction

18. In system analysis, what is the purpose of creating "Data Dictionaries"?
    a. To list all the processes in the system
    b. To define and describe data elements, their relationships, and constraints
    c. To test system performance
    d. To track project progress

19. Which of the following is **NOT** a characteristic of a system?
    a. It has interrelated components
    b. It has a specific purpose or goal
    c. It cannot be divided into smaller components
    d. It interacts with its environment

20. Which method is used to gather system requirements from users?
    a. Data flow diagrams
    b. Interviews and questionnaires
    c. Class diagrams
    d. Program coding

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2025

Level : BIT
Year : I
Time : 2 hrs. 30 mins.

18 APR 2025

Course : COMP 302
Semester : II
F. M. : 40

SECTION "B"
[6 Q × 4 = 24 marks]

Attempt ***ANY SIX*** questions.

1. What do you understand by *"System Analysis and Design"*? How does it help in developing an effective information system?

2. Explain the importance of *gathering user requirements* during the system analysis phase. What methods can be used to gather these requirements effectively?

3. In your opinion, what are the main challenges a *system analyst* faces during the design phase? How can these challenges be overcomed?

4. What is the significance of *"user-centered design"* in system analysis? How does it impact the overall success of a system?

5. Discuss the role of communication between *stakeholders* (*users, developers, and analysts*) in the system design process. How does effective communication affect system outcomes?

6. What is the difference between *functional* and *non-functional requirements* in system analysis and design? Provide examples for each.

7. What is the relationship between *system analysis* and *system design*? How does a well-conducted analysis phase influence the design and development phases?

SECTION "C"
[2 Q × 8 = 16 marks]

Attempt ***ANY TWO*** questions.

8. The System Analyst plays a central role in the Software Development Life Cycle (SDLC). Discuss the responsibilities of the System Analyst throughout the SDLC, from planning and analysis to design and implementation. What skills are essential for a System Analyst, and how do these skills contribute to the success of the project? Reflect on the challenges a System Analyst might face during each phase and how they can address these challenges effectively.

9. Prototyping is a widely used approach in system development, especially in the design phase. Discuss the concept of system prototyping in System Analysis and Design. What are the key advantages and disadvantages of using prototyping compared to traditional development methods? In your answer, consider the impact of prototyping on user involvement, system testing, and overall project timelines. Provide examples of situations where prototyping would be most beneficial and when it might not be the best approach.

P.T.O.

10. Discuss the concept of database normalization and explain its importance in database design. Describe the process of transforming a database from the unnormalized form (UNF) to the First, Second, and Third Normal Forms (1NF, 2NF, and 3NF). For each normal form, provide a practical example of a database table that violates that form and explain how to resolve it. Additionally, explain the potential advantages and disadvantages of normalization in database management.

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2025

Marks Scored:

Level : B.E.
Year : I

Course : ENGG 112
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 15 APR 2025

SECTION "A"
[20Q. × 0.5= 10 marks]

Choose and encircle the most appropriate option from each set of choices

1. In a resistor, the color coding is given as follows 1st band: brown, 2nd band: black, 3rd band: black, 4th band, tolerance in %: gold. What is the value of resistance?
   a. 10Ω 1% tolerance
   b. 100Ω 1%tolerance
   c. 10Ω 5% tolerance
   d. 100Ω 5%tolerance

2. Ideal voltage source has _____.
   a. Zero internal resistance
   b. Large value of current
   c. Infinite internal resistance
   d. Low value of voltage

3. The resistance of delta equivalent of the star connection in **Figure 1** is equal to
   a. 40Ω b. 20Ω c. 6.66Ω d. 60Ω

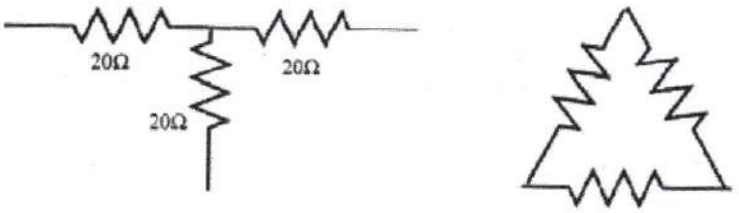


Figure 1

4. A series R-L-C circuit has a series resonating frequency of 12000 Hz. If R = 5Ω and if X_L at resonance is 300Ω, the bandwidth is _____.
   a. 200 Hz b. 60 Hz c. 40 Hz d. 8 Hz

5. The power factor at resonance in RLC series circuit is
   a. 0 b. 0.8 lagging c. 0.8 leading d. 1

6. The apparent power drawn by an AC circuit is 10kVA and active power is 8KW. The reactive power in the circuit is _____.
   a. 2 kVAR b. 6 kVAR c. 8 kVAR d. 10 Kvar

7. The current across the open circuit is _____.
   a. minimum b. maximum c. negative d. zero

8. The value of I for the circuit of **Figure 2** is _____ mA

a. 1.8 b. -1.8 c. -3.6 d. 3.6

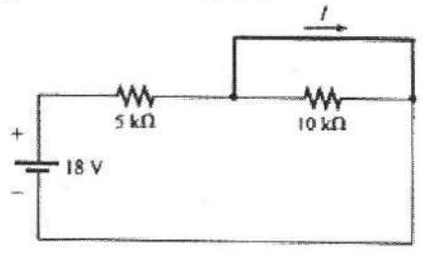


Figure 2

9. Which of the following statement is correct for the balanced three phase star connected system

a. $V_L = V_\varphi$ and $I_\varphi = I_L$ b. $V_L = \sqrt{3}V_\varphi$ and $I_\varphi = I_L$

c. $V_L = V_\varphi$ and $\sqrt{3}I_\varphi = I_L$ d. $V_L = V_\varphi$ and $I_\varphi = \sqrt{3}I_L$

10. Norton's Equivalent circuit consists of

a. series combination of R_N,V_N, and R_L b. series combination of R_N ,V_N

c. parallel combination of R_N,V_N d. parallel combination of R_N,V_N , and R_L

11. You have to connect 1500 Ω resistor in a circuit but you have some 1000 Ω resistors only, how would you connect 1000 Ω resistors to obtain 1500 Ω?

a. 2 in parallel b. 2 in parallel and 1 in series

c. 2 in series d. 2 in series and 1 in parallel

12. What is the phase relationship between the given sinusoidal waveforms? $V = 10 \sin(\omega t + 30°)$ and $I = 5 \sin(\omega t - 70°)$

a. V leads I by 70° b. I leads V by 30°

c. V leads I by 100° d. I leads V by 100°

13. Inductor behaves as open circuit at _____.

a. infinity frequency b. zero frequency

c. resonance frequency d. cut-off frequency

14. For maximum power transfer to the load, the value of load resistance (R_L) should be _____.

a. maximum b. minimum c. R_{TH} d. $4R_{TH}$

15. In DC machines, number of commutator segments is equal to _____.

a. number of armature coils b. number of armature coil sides

c. number of armature turns d. number of armature conductors

16. In a series RL circuit, if the apparent power is 300 kVA and the reactive power is 180 kVAR, the reactive power is _____.

a. 80 kW b. 240 kW c. 233 kW d. 90 kW

17. In the following **Figure 3**, current flowing through the 30 Ω resistor is _____.

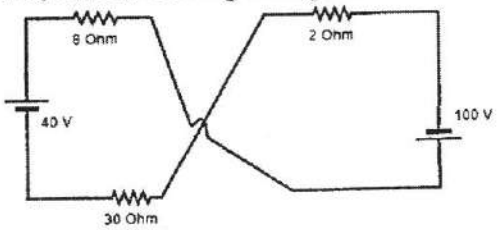


Figure 3

a. 5.5 A b. 3.5 A c. 1.5 A d. 0.5A

18. At what frequency will an inductor of 5 mH have the same reactance as a capacitor of 0.1 μF?
a. 2.13 KHz b. 5.67 KHz c. 7.12 KHz d. 9.32 KHz

19. The value of current I of the circuit in **Figure 4** is approximately _____.
a. 72.57 ∠38° b. 40.16 ∠60° c. 51.61 ∠ 32° d. 43.36 ∠ 66°

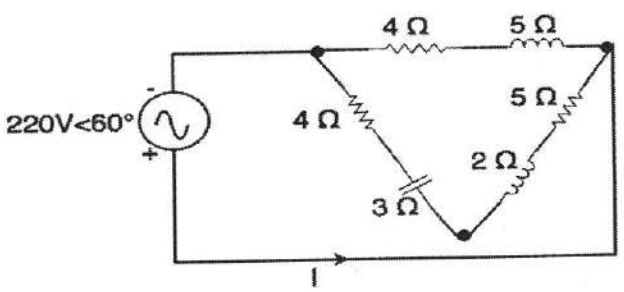


Figure 4

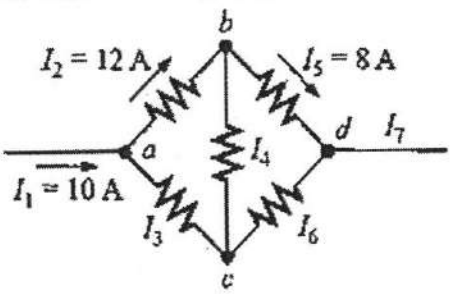


Figure 5

20. The current (I_3) in the circuit of **Figure 5** is _____ A.
a. 2 b. 10 c. 22 d. 30

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SECTION "B"
[4 Q × 10 = 40 marks]

Attempt ***ANY FOUR*** Questions. Assume suitable data, if necessary. Symbol has their usual meaning.

1.

a. For the circuit shown in **Figure 1**, find the equivalent resistance. Assume all the resistor have resistance of **10Ω**. [5]

b. Determine the current through the source resistor R_S of the network of **Figure 2** using **Nodal Analysis.** [5]

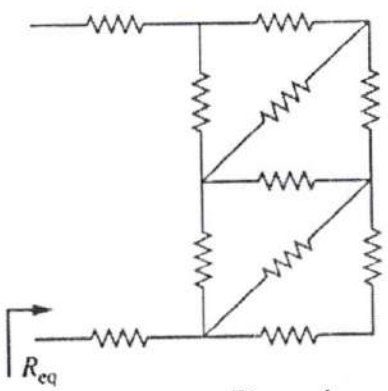

Figure 1

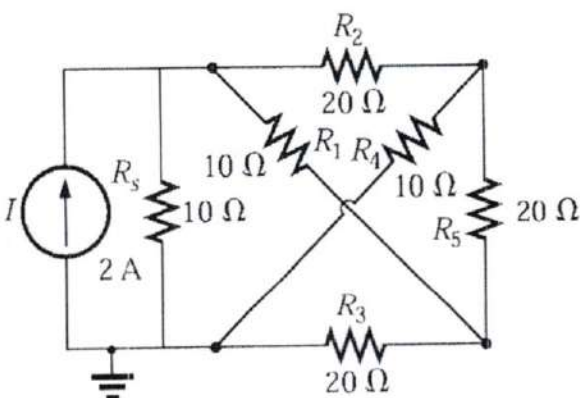

Figure 2

2.

a. Calculate the indicated currents and voltages shown in **Figure 3**. [5]

i. I_S
ii. V_7
iii. I_5

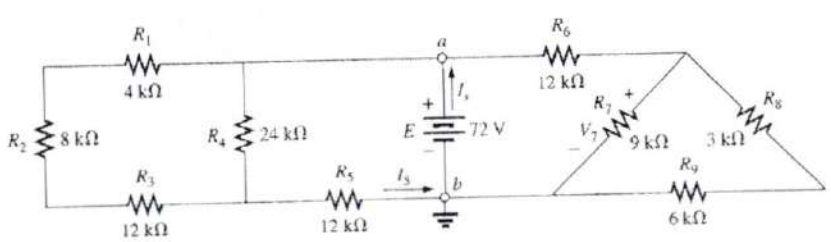

Figure 3

P.T.O.

b. For the network shown in **Figure 4** determine the **Thevenin equivalent** circuit for the network external to the load resistance R_L. [5]

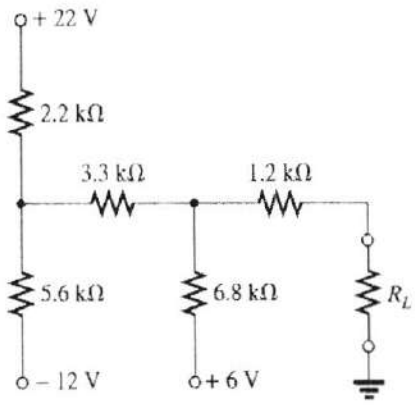

Figure 4

3.

a. Find the **average and RMS** value of the periodic waveform in **Figure-5**. [5]

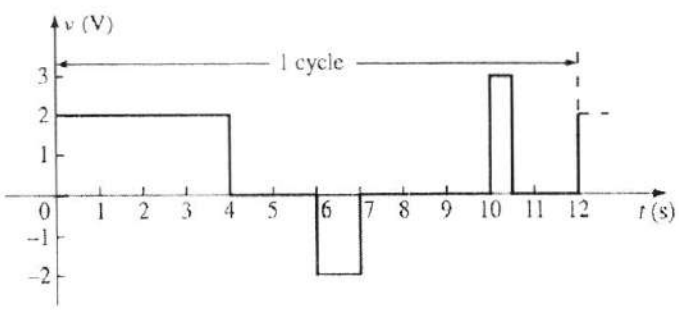

Figure 5

b. Using the **Mesh analysis** to determine the current through the resistor R_1 for the network of **Figure 6.** [5]

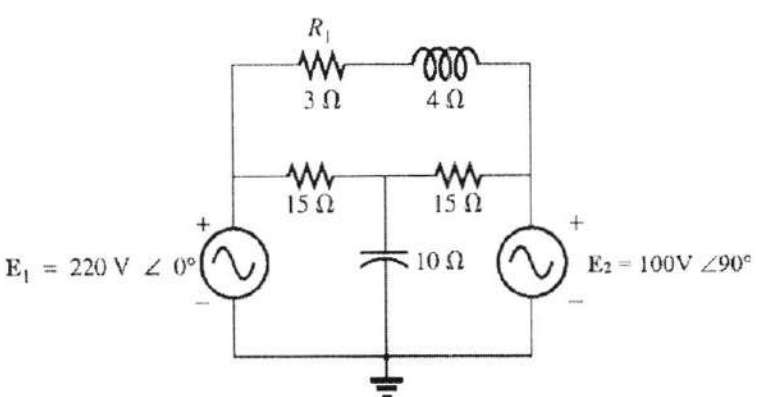

Figure -6

4.

a. An impedance of (4-j10)Ω is connected in parallel with an impedance (6+j8). The circuit is fed from a 230V, 50Hz supply. Find the current through each branch, total circuit current, total impedance, Power factor(p.f.), active power, reactive power and apparent power. Also draw the phasor diagram for voltages and currents in the circuit. [5]

b. Explain construction and working principle of DC generator. [5]

5.

a. For the iron-core transformer (k = 1) of **Figure-7** [5]

i. find the magnitude of the induced voltage E_s.

ii. find the maximum flux ϕ_m.

iii. if the maximum flux passing through the core is 12.5 mWb, find the frequency of the input voltage.

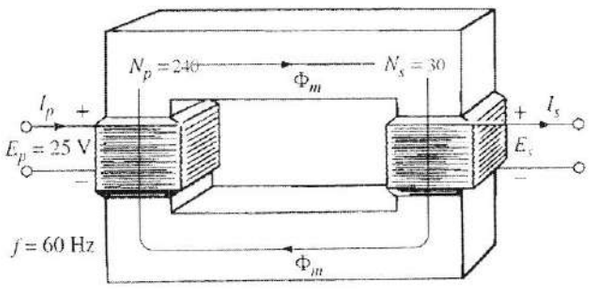

Figure 7

b. For the Δ-Y system as shown connected load in **Figure 8**. [5]

i. Find the total average power.

ii. Find the total reactive power.

iii. Find the total Apparent Power.

iv. Fin the power factor of the load.

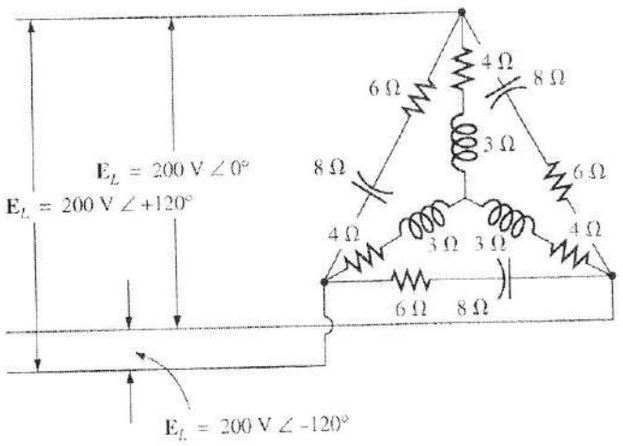

Figure 8