Name...Himanshu...Dixit...   Enrollment No. .....2110326.2...............

Jaypee Institute of Information Technology, Noida
T2 Examination, 2022
B.Tech. II Semester

Course Title: Electrical Science-1   Maximum Time: 1 hrs
Course Code: 15B11EC111   Maximum Marks: 20

After pursuing this course, students will be able to:

[CO1] Recall the concept of voltage, current, power and energy for different circuit elements, apply Kirchhoff laws and different analyzing techniques to identify the different circuit parameters.

[CO2] Define and apply the network theorems in the complex AC and DC circuit networks. Demonstrate the physical model for the given sinusoidal AC signal and construct the phasor diagrams.

[CO3] Demonstrate the concept of resonance and operate different instrumental and measurement equipments.

[CO4] Demonstrate the conception and working of single phase transformer.

Note: Attempt all questions.

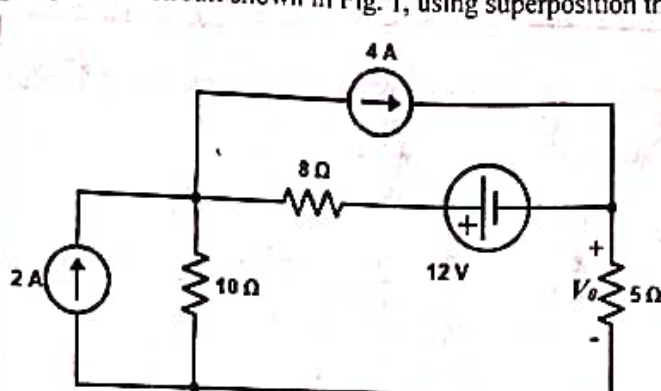**Q. 1** Find the voltage V_o for the circuit shown in Fig. 1, using superposition theorem.   [4, CO2]

Fig. 1

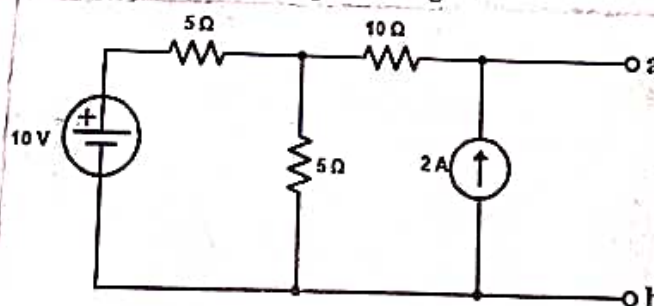**Q. 2** Find the Thevenin's equivalent circuit given in Fig. 2.   [4, CO2]

Fig. 2

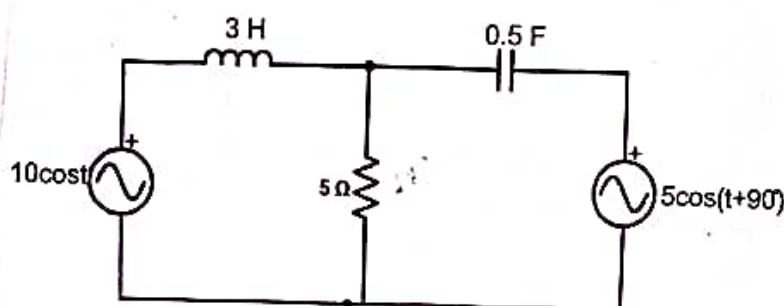**Q. 3** Find the current through 5Ω resistor of the circuit shown in Fig.3 using Norton's Theorem.   [4, CO2]

Fig. 3

Name_____   Enrollment No._____

Jaypee Institute of Information technology, Noida
T2 Examination, 2022
B.Tech II semester

Course Title: Physics-2   **Maximum Time: 1 Hr**
Course Code: 15B11PH211   **Maximum Marks:20**

After pursuing this course, the students will be able to

CO1 Recall the basic concepts relating to electromagnetic theory, lasers, fiber optics and solid state physics.
CO2 Illustrate the various physical phenomena with interpretation based on the mathematical expressions involved.
CO3 Apply the basic principles in solving a variety of problems related to lasers, electromagnet theory, fiber and solid state physics.
CO4 Analyze and examine the solution of the problems using physical and mathematical concepts involved in the course.

Note: Attempt all the questions.

1.[CO1]   (a) Draw refractive index profiles for step index fibre and graded index fibre.

(b) Consider an electromagnetic plane wave $\overline{E} = E_o(\hat{i} + b\hat{j})\cos\left[\frac{2}{\pi}\{ct - (x - \sqrt{3}y)\}\right]$, where λ is wavelength, c is the speed of light. Find the value of constant b.

(c) Define population inversion.

(d) Find Brewster's angle for a parallel polarized wave travelling from air into glass ($n_g = 1.5$).

(e) The amplitude of an electric field in a plane EM wave is 100 Newton/Coulomb. The wave is travelling in the x- direction and the electric field is in y- direction. Find the amplitude of magnetic field and its direction.

[1×5]

2.[CO2]   (a) A light beam travelling through water ($n_w = 1.33$) falls normally on a glass ($n_g = 1.5$). Calculate the reflectivity and the transmittivity.

(b) Explain the working of three level lasers with the help of labelled diagram.

(c) The optical fibre cable of 3 km long made up of three 1.0 km length spliced together. The losses due to each length and splice are respectively 5 dB and 1 dB. What would be output power if the input power is 5 mW.

[2×3]

3.[CO3]   (a) At t=0, a 2 eV energy state has 10^6 atoms. At t = 4 ns, the number of atoms in 2 eV state is $10^6/e^2$ Assuming only $\Delta E < 0$ transitions are possible. Let the energy of the ground state be 1 eV. Find the Einstein's coefficients for this two level system.

(b) Consider the propagation of incident light with an electric field $\overline{E}_1 = 3\hat{a}_x - 2\hat{a}_y + 5\hat{a}_z$ from free space to the dielectric medium with refractive index 1.5. Find $\overline{D}_2$.

[2×2]

4.[CO4]   We wish to design a multimode step index fibre with V number, V=100 and numerical aperture, NA=0.3 and the refractive index of the core $n_{co}=1.458$. This fibre will be used in data link with the source of 0.82 μm light emitting diode (LED). Determine the fibre core radius and refractive index of cladding. Calculate the number of reflections per unit length suffered by a ray incident at the acceptance angle with respect to the fibre axis.

[3]

Constants: $\varepsilon_o = = 8.86 \times 10^{-12}$ F/m, $\mu_o = 4\pi \times 10^{-7}$ N/A^2, c = 3×10^8 m/s, k=$1.38 \times^{-23}$ Joule/K

Q. 4 Find the value of load resistance (R_L), for obtaining maximum power through the [4, CO2] load. Also find maximum power for the circuit given in Fig.4.
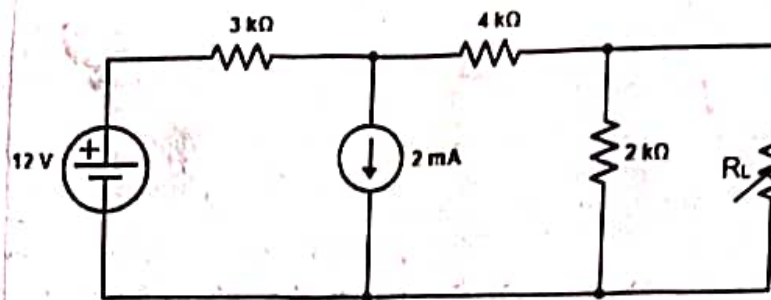

Fig. 4

Q. 5 (a) The voltage across an element is given by $v(t) = 10\sin(4t-100°)$ V, and corresponding [1, CO2] current through that element is $i(t) = -12\cos(4t-40°)$ A. Find the phasor relationship among above voltage and current.

Q. 5 (b) Find the value of equivalent impedance (Z) and equivalent admittance (Y) for the [3, CO2] circuit given in Fig.5. Consider $\omega = 1$ k rad/sec.
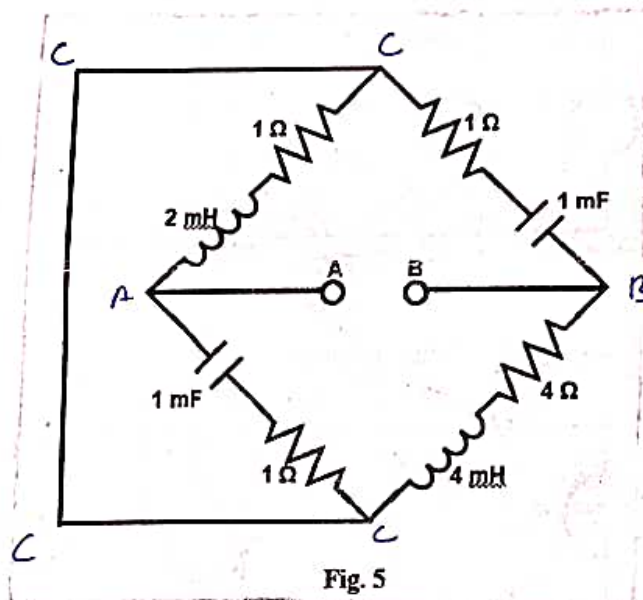

Fig. 5

Name Rohan   Enrolment No 2 1103261

Jaypee Institute of Information Technology, Noida
T2 Examination 2022
Semester-II

Course Title: Software Development Fundamentals-II   Max. Hours:1 Hr
Course Code:15B11CI211   Max. Marks:20

	COURSE OUTCOMES	COGNITIVE LEVELS
CO1	Explain various object-oriented concepts like class and objects, friend function, function and operator overloading, etc.	Understand
CO2	Apply and implement the relationships of association, aggregation, composition, and inheritance	Apply
CO3	Analyze the output of the source code and able to debug the errors	Analyze
CO4	Design the class diagram for real-life problems and implement it using virtual functions, abstract classes, templates, and exception handling	Create
CO5	Apply SQL commands to create tables and perform various operations like insert, delete, select, etc.	Apply

1. Write a C++ code having the following details:

    a) A base class Person having two pure virtual functions getData() and isoutstanding().
    b) Your parent class should also include two member functions to input() and display() the name of person.
    c) Your code includes two derived classes, Student and Instructor respectively.
    d) The derived classes each contain a function called getData () and isoutstanding (). getData() function of Student class should input name of person and asks user to input GPA whereas isoutstanding() function determines either the GPA>3 (outstanding) or not.
    Similarly. getData() function of Instructor class should input name of person and asks user to input no. of publications whereas isoutstanding() function determines either the no. of publications >50 (outstanding) or not.
    e) Student and Instructor objects are casted into the person class type through array of pointers. Ask user first either he is student/instructor, then get his data using getData() and your program continues to ask to enter the data until the last personnel enters the data. Once the data is entered, print the names of all personnel along with their outstanding or not. [5 Marks] [CO-3]

2. A scholar studying in a department is identified by his name, enrollment number and year of registration. Each scholar can perform some functionalities like course registration, write thesis etc. Further, it is compulsory for each scholar to write his/her one thesis and submit it for degree allotment. The scholar's thesis must consist of six chapters. Also, a thesis is identified by its title and number of pages. To write the thesis, a scholar needs to read different articles (or study material). Each article has an ISBN number and title. Further, each article can be categorized as a book or a research paper. A book has a publisher, author, and subject name. A research paper has attributes like title, impact factor etc. For awarding degree, each scholar must be registered in any one department. However, a department can enroll any number of students with maximum seats as 50.
    With respect to the above case study perform the following: [CO-2]

    a) [3 Marks] Represent the above scenario with the help of a complete class diagram. Draw necessary classes with their attributes and functionalities. Also, mention the relationships and their multiplicity, direction and roles properly.
    b) [3 Marks] Write a C++ program to just show the implementation of the relationship between Scholar, Thesis and Chapter class. You don't need to implement the entire class diagram.

3. Write a program that can throw integer and double exceptions in the same try block. For both exceptions, implement the exception handling blocks with three different catch blocks of type (int, double, and default). Default catch block which can accept any exception. [Marks 4] [CO-4]

4. Find the error/output of the following programs. [2.5 Marks Each] [CO-3]

1.

```cpp
#include<iostream>
using namespace std;
class A
{
  public: A()
  {cout<<"\n 1";}
  A(int x)
  {cout<<"\n 2";}
  virtual void T2()
  { cout<< "\n A T2()"; }
  ~A()
  {cout<<"\n A dead";}
};
class E
{
  public: E()
  {cout<<"\n 3";}
  E(int x)
  {cout<<"\n 4";}
};

class B: virtual public A
{
  public: B()
  {cout<<"\n 5";};
  B(int x) {cout<<"\n 6";};
  void T2()
  {cout<<"\n B T2()";}
  ~B()
  {cout<<"\n B dead";}
};

class C: virtual public E
{
  public: C()
  {cout<<"\n 7";}
  C(int x)
  {cout<<"\n 8";}
};

class D: public C, public B
{
  public: D(): E(5), B(1)
  {cout<<"\n 9";}
  D(int x): A(3), C(2)
  {cout<<"\n 10";}
  void T2()
  {cout<<"\n D T2()";}
  ~D()
  {cout<<"\n D dead";}
};

int main()
{
  B* obj=new D(2);
  obj->T2();
  delete obj;
}
```

2.

```cpp
#include <iostream>
using namespace std;
class University
{
public:
  University() {}
  virtual void print() { cout << "University"; }
};
class Institute: public University
{
public:
  Institute() {}
  void print() { cout << "Institute"; }
};
int main()
{
  try
  {
    try
    {
      throw Institute{};
    }
    catch (University &b)
    {
      cout << "Exception in University, which is actually ";
      b.print();
      cout << "\n";
      throw b;
    }
  }
  catch (University &b)
  {
    cout << "Exception in University, which is actually ";
    b.print();
    cout << "\n";
  }
  return 0; }
```

Name. Himanshu Dixit....   Enrollment No.: .....211.03262...........

Jaypee Institute of Information Technology, Noida
T2 Examination, Even 2022
B.Tech. II Semester

Course Title: Mathematics 2   **Maximum Time: 1 Hr**
Course Code: 15B11MA211   **Maximum Marks: 20**

After pursuing the course, the students will be able to:

CO1: Apply different methods for solving ordinary differential equations of second order.
CO2: Explain different tests/methods of convergence for infinite series.
CO3: Find the series solution of differential equation and use it to construct Legendre's polynomials and Bessel's functions.
CO4: Classify the partial differential equations and apply Fourier series to find their solution.
CO5: Explain Taylor's & Laurent's series expansion, singularities, residues and transformations.
CO6: Apply the concept of complex variables to solve the problems of complex differentiation and integrations.

Note: Attempt all questions.

Q1. State the orthogonal property of Legendre's polynomial and use it to evaluate   **[CO3, 3M]**

$$\int_{-1}^{1} [100 + 63x]P_3(x)P_4(x)dx.$$

Q2. Show that   **[CO3, 2M]**

$$\int x^3 J_0(x)\, dx = x^3 J_1(x) - 2x^2 J_2(x) + c.$$

Q3. Find the series solution of the following differential equations by reducing it in Bessel's   **[CO3, 2M]**
differential equation:

$$\frac{d^2y}{dx^2} - \frac{4}{x}\frac{dy}{dx} + 36\left(x^4 - \frac{1}{x^2}\right)y = 0.$$

Q4. Discuss the nature of $x = 0$ for the following differential equation and hence find the   **[CO3, 4M]**
series solution about $x = 0$:

$$2x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - (x + 1)y = 0.$$

Q5. Find the Fourier series expansion of the periodic function $f(x) = x + \pi, -\pi < x < \pi$,   **[CO4, 3M]**
with a period of 2π.

Q6. (a). Classify the following partial differential equation: **[CO4, 1M]**

$$\frac{\partial^2 u}{\partial x^2} + 2x\frac{\partial^2 u}{\partial x\, \partial y} - x^2\frac{\partial^2 u}{\partial y^2} + \frac{\partial u}{\partial y} = 0.$$

(b). Find the solution of the wave equation   **[CO4, 5M]**

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}, \quad 0 < x < 1$$

with

$$y(0, t) = y(1, t) = 0;$$
$$y(x, 0) = x(1 - x), \text{ and } y_t(x, 0) = 0,$$

using the separation of variables method with Fourier series.