Name..Himanshu..Dixit   Enrolment No...21103262

JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY
End Semester Examination, Even 2022
B.Tech II Semester

Course Title- Physics 2
Course Code-15B11PH211

Maximum Time-2hr
Maximum Marks-35

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: all the questions are compulsory and answer in sequential order. Symbols have their usual meanings.

1.[CO1] (a) Write down at least two differences between classical and quantum free electron theory.   **[2]**

(b) Write the boundary conditions of electric and magnetic field at the interface of two media with permittivity and permeability ($\varepsilon_1,\varepsilon_2$) (μ_1,μ_2) respectively.   **[2]**

(c) Can laser be produced by two level system? Justify with reasoning.   **[1]**

(d) Discuss the physical significance of numerical aperture of an optical fiber.   **[1]**

(e) Write down the coordination number of FCC and BCC crystal structures.   **[1]**

2.[CO2] (a) What are the basic assumptions in the Kronig Penney model? Using diagram distinguish amongst the band structures of semiconductors, metals, and insulators.   **[3]**

(b) If a crystal plane intercepts $\hat{x}$, $\hat{y}$, and $\hat{z}$ axes at 3,3,2 units respectively. Find the Miller indices and draw the plane in unit cell.   **[3]**

(c) Calculate the packing fraction of a BCC unit cell.   **[2]**

3.[CO3] (a) What is the effective mass of an electron in a crystal? Find the effective mass and velocity of an electron in a crystalline solid with E-K relation $E = \frac{\hbar^2 k(2k-b)}{2m}$ where, m = 9.1×10^{-31} kg and b is constant.   **[3]**

(b) If n for KCl is 5.77, Madelung constant is 1.75 and nearest neighbour separation is 0.314 nm. Calculate the cohesive energy. Use Ionisation energy = 4.1eV and Electron affinity = 3.6eV.   **[3]**

(c) The interaction energy of two particles in the field of each other is given by, $U(r) = -\frac{a}{r^6}+\frac{b}{r^{12}}$, where r is the inter atomic distance and a and b are constants. Show that (i) particles form a stable state for $r = r_o = [\frac{2b}{a}]^{1/6}$; (ii) the ratio of the energy of attraction to the energy of repulsion is 2. (iii) find the potential energy of the stable configuration.   **[3]**

(d) Calculate the conductivity and resistivity for metal assuming $\tau = 3.0\times10^{-14}$sec, T = 300 K and electron concentration 2.5×10^{22}/cm^3.   **[2]**

4.[CO4] (a) Evaluate the electric field inside and outside a sphere of radius R which carries a charge density proportional to the distance from the origin, $\rho = kr$ where, k is a constant.   **[3]**

(b) An X-ray beam of wavelength 1.54Å is diffracted from the (110) planes of a solid with a simple cubic lattice of lattice constant 3.08 Å. Calculate the angle at which the first order Bragg's diffraction takes place.   **[3]**

(c) For a fiber the refractive index of core and cladding is 1.54 and 1.5 respectively. The radius of core is 2.5 μm. For 1500 nm wavelength. Calculate the V-number and number of modes, also mention whether this fibre is single mode or multimode for the given wavelength?   **[3]**

Constants: h = 6.626×10^{-34} J-s; ε_o = 8.85 x 10^{-12} F/m ; μ_o = 1.256×10^{-6} H/m; c = 3×10^8 m/s

Name __Himanshu Dixit__   Enrollment No.__21103262__

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

Course Title : Life Skills and Effective Communication   **Maximum Time : 2 Hrs**
Course Code : 22B12HS111   **Maximum Marks : 35**

After pursuing the course the students will be able to:
CO1: Understand different life skills required for self, family, society and lifelong success.
CO2: Apply listening, speaking, reading and writing skills in professional environment.
CO3: Develop work-place skills for personal and professional excellence.
CO4: Evaluate and make decisions for empowerment of self and others.

1. The first most important thing in human life is to understand oneself. Everything   [3,CO1]
    depends upon the extent to which any individual understands and accepts self.
    Briefly explain the dimensions of the Self. Joseph Luft and Harry Ingham in 1955
    developed a technique which helps a person to learn and discover things about
    themselves. Name and explain the technique in detail.

2. Gary T. Hunt has given three rhetoric strategies which is applicable even today   [3,CO2]
    specifically in persuasive speeches. Explain those strategies with example.

3. a) In these days controlling the direction of conversation is very challenging. To   [2,CO2]
    understand how to manage rejection and disagreement in the course of conversation
    is an important task. Identify the possible directions that a conversation can take.

    b) Infer the Lexical and contextual meaning of the word "Bank"   [1,CO2]

4. Geeta Sundaram is an office manager. Her awareness of her own and others emotion   [3,CO3]
    is almost nil. She is moody and unable to generate much enthusiasm or interest in
    her employees. She does not understand why employees get upset with her. She
    often overreacts to problems and chooses the most ineffectual responses to emotional
    situations. What is Emotional Intelligence? Using the above situation elaborate on
    the five components of Emotional Intelligence.

5. Each member of a car racing team is responsible for a loss or win in the race.   [2,CO3]
    Providing direction, momentum and commitment, the pit crew's plan is to function at
    top speed with no errors in checking the car, fixing parts, changing tires and
    pumping gas. List and explain any four pre-requisites of team building and
    teamwork.

6. Rajat is going through a difficult time in professional life as well as in personal life.   [3,CO3]
    Briefly explain Resilience and suggest as well as explain any two types of resilience
    skills which can help him in coming out of these situations.

Name __Himanshu Dixit__   Enrollment No.__21103262__

Jaypee Institute of Information Technology, Noida
End Term Examination, 2022
B.Tech 2nd Semester

Course Title : Electrical Science-1   Maximum Time : 2 Hr.
Course Code : 15B11EC111   Maximum Marks: 35

CO1: Recall the concept of voltage, current, power and energy for different circuit elements. Apply the Kirchhoff's laws and different analysing techniques to identify the different circuit parameters.
CO2: Define and apply the network theorems in the complex AC and DC circuits, networks. Demonstrate the physical model for 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 construction and working of single phase transformer.
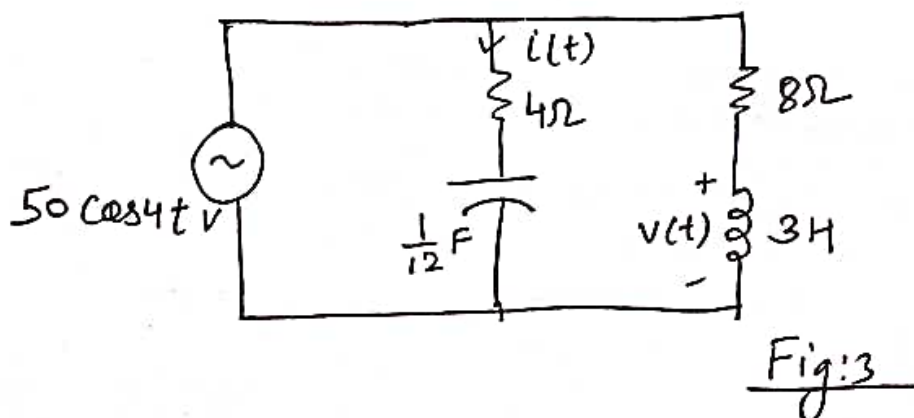
Note: Attempt all questions

Q1. (a) [CO1] Calculate i_x and the power dissipated by the circuit as shown in Fig. 1, if the current i_o= 2A. [2]

Fig:1
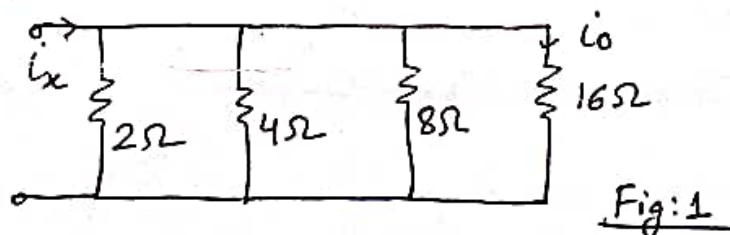
(b) [CO2] Using source transformation, determine voltage v_o and current i_o in the circuit as shown in Fig. 2. [4]

Fig:2
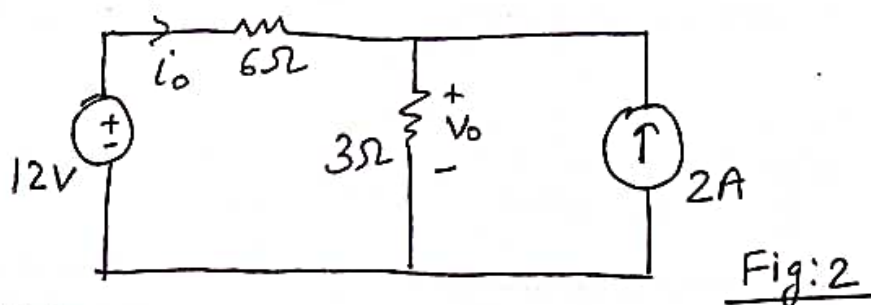
Q2. [CO2] Calculate the value of current i(t) and voltage v(t) in the circuit as shown in Fig. 3. [4]

Fig:3

Q3. [CO3] (a) Discuss briefly the phenomenon of resonance in electrical circuits.

[1]

(b) A series RLC circuit has a 100 Ω resistance and an inductance of 0.318 H along with a capacitance. When this circuit is energised by a current source of value $230\angle 0°$ A. Find (i) the value of the capacitance (ii) the voltage across the inductance and the total power consumed. $f = 50 Hz$ [3]

Q4. [CO3] (a) Define half power points and bandwidth for a parallel RLC circuit. [1]
(b) How the quality factor is affected by bandwidth of the circuit.   [1]
(c) A parallel resonant circuit consists of parallel combination of 65 pF capacitor, 56 µH inductance and 60 Ω resistance. Determine (i) resonant frequency (ii) quality factor at resonance frequency.   [2]

Q5. [CO3] (a) Explain different methods of controlling torque in indicating instruments.   [2]
(b) In a gravity control instrument, the controlling weight is 0.005 Kg and acts at a distance of 2.4 cm from the axis of the moving system. Determine the deflection in degrees corresponding to deflection torque of 1.03×10^{-4} Kgm.   [3]

Q6. [CO3] The resistance of a moving coil voltmeter is 12000 Ω. The moving coil has 100 turns and is 4 cm long, 3 cm wide. The flux density in the air gap is 6×10^{-2} Wb/m^2. Find the deflection produced by 300 V, if the spring control gives a deflection of one degree for a torque of 25×10^{-6} N/m.   [4]

Q7. [CO4] A single phase, 50 Hz transformer has 20 primary and 250 secondary turns. The net cross-sectional area of the core is 150 cm^2. If the primary winding is connected to a 230 V, 50 Hz supply, calculate (i) peak value of flux density in the core (ii) the voltage induced in the secondary winding and (iii) the primary current when the secondary current is 100 A. (neglect losses)   [4]

Q8. [CO4] In a single phase 150 KVA transformer, the required no-load voltage ratio is 5000/250 V. (a) If the transformer's primary and secondary resistances are $R_1=10Ω$ & $R_2=0.02$ Ω, respectively. Calculate total equivalent resistance of primary side.

[2]

(b) If the power factor lagging is 0.8, find the efficiency at half rated KVA, where the given copper losses are 1800 W and core losses are 1500 W at full load.   [2]

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

Course Title: Software Development Fundamentals-II   **Maximum Hours: 2 Hr**
Course Code:15B11CI211   **Maximum Marks: 35**

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

CO1   Explain various object-oriented concepts like class and objects, friend function, function and operator overloading, etc.

CO2   Apply and implement the relationships of association, aggregation, composition, and inheritance

CO3   Analyze the output of the source code and able to debug the errors

CO4   Design the class diagram for real-life problems and implement it using virtual functions, abstract classes, templates, and exception handling

CO5   Apply SQL commands to create tables and perform various operations like insert, delete, select, etc.

1. Consider an educational institute having regular and guest faculties with the following details:
    a) A base class Staff with two attributes: staffId, name and three-member functions. The two functions: addDetails() and display() are used to add and display the staff details and the third function Calculate() is a pure virtual function that will calculate the salary of the staff.
    b) There are two derived classes: RegularFaculty and GuestFaculty.
    c) Regular faculty have four attributes: designation, department, yearofexperience and publications and three member functions: isPromoted() ,Calculate() and display(). isPromoted() will return 1 if yearofexperience in the institute more than 5 years and publication is more than 15 else 0 is returned. Calculate() computes the faculty gross salary. Regular faculty basic is taken as an input to compute gross salary. Gross salary is computed by adding basic with components like 50% DA of basic, 15% HRA of basic and 20% TA of basic function. display() will print all the details.
    d) Guest Faculty have two attributes: specialization & totalClassesTaught and two member functions: Calculate() & display(). Calculate() computes the guest faculty salary. For guest faculty, the monthly payment is computed based on number of classes taught. Payment per class is Rs. 1000. and display() will print all the details.

    Write a C++ Code to input information of five guests and five regular faculties and calculate their salary (use array of objects or dynamic memory allocation).
    e) Draw the UML Diagram with all class attribute to depict the relationship shown by the above statement. [5+2 Marks] [CO-1 & CO-2]

2. Write a program using function template void minsize(T a, U b) which accepts two variables a and b (of different or same datatypes) as input and prints which variable has the highest size (in bytes). If both variables are of the same size, then print the appropriate message. Your template should work for the following data types: int, char, float, double, and string (represented using an array of characters). In case both input variables are strings, then the string with more number of characters is assumed to be of greater size. [6 Marks] [CO-4]

3. Write a C++ program to open two files, input.txt and output.txt respectively. Check each one for being open or not, and then read each integer from the input file (assume that all the contents of the input.txt file are integers and every integer is separated by space). Then double each integer value and write it on the output.txt file. [6 Marks Each] [CO-4]

4. Consider the following database table of M.Tech students in JIIT Noida: [6 Marks Each] [CO-5]

MTech_Student (Stud_id, Stud_name, Stud_year, Stud_course) Course (course_name, room_No, faculty_id) Faculty (F_id, F_name, dept_name)	Write SQL command for the following:

1) Create the MTech_Student, Course, and Faculty table. Take appropriate data type. [1.5 Marks]
2) Insert the following values: [1.5 Marks]
    a)   MTech_Student (9912302022, 'ABC', 2, 'DS')
    b)   Course ('SDF2', 'LT2', 0004)
    c)   Faculty table: (0001, 'ABC', 'CSE')
3) Update the course as 'AI' for M.tech students who are in 2 year. [1 Marks]
4) Print the course_name of all courses which are taken in rooms that end with '4'. [2 Marks]

5. Find the error/output of the following programs. Justify your answer. [2.5 Marks Each] [CO-3]

1.

```cpp
#include <iostream>
using namespace std;
class Car {
    int a;
public:
    Car() {}
    Car(int x) { cout << "Car called" << endl; }

    friend void showA(Car&);
};
void showA(Car& x) { cout << "Car::a=" << x.a << endl; }
class Petrol : virtual public Car {
public:
    Petrol(int x) :Car(x) {
        cout << "Petrol called" << endl;
    }
};
class CNG : virtual public Car {
public:
    CNG(int x) :Car(x) {
        cout << x << "CNG called" << endl;
    }
};
class Hybrid : public Petrol, public CNG {
public:
    Hybrid(int x) :CNG(x), Petrol(x) {
        cout << " Hybrid called" << endl;
    }
};
int main()
{Car a;
 showA(a);
 Hybrid c1(150);
 return 0;
}
```

2.

```cpp
using namespace std;
#include<vector>
#include<map>
#include<string>
#include <iostream>
int main()
{
    // empty map container
    map<char, int> m;
    string message = "Welcome to End Term
Examination";
    string::iterator it;
    map<char, int>::iterator itr;
    for (it = message.begin(); it != message.end();
it++) {
        itr = m.find(*it);
        if (itr == m.end()) {
            m.insert(pair<char, int>(*it, 1));
        }
        else
        {
            itr->second = itr->second + 1;
        }
    }
    for (itr = m.begin(); itr != m.end(); ++itr)
    {
        cout << '\t' << itr->first << '\t' << itr-
>second
            << '\n';
    }
    cout << endl;
}
```

3.

```cpp
#include<fstream>
#include<iostream>
using namespace std;
int main()
{
fstream fp; char buf[100];  int pos;
fp.open("file.txt", ios::out | ios::ate);
fp << "This Vacation work.at an NGO";
pos = fp.tellp();
cout<<"Current position of put pointer:"<<pos<<
endl;
fp.seekp(-6, ios::cur);
fp << "Temple ";
fp.seekg(0);
fp.seekp(5, ios::beg);
fp << "Summer   ";
fp.close();
fp.open("file.txt", ios::in | ios::ate);
fp.seekg(0, ios::beg);
while (!fp.eof())
{
    fp.getline(buf, 100);
    cout << buf << endl;
}
pos = fp.tellg();
cout << "\nCurrent Position of get pointer : " <<
pos << endl;
    return 0;
}
```

4.

```cpp
#include<iostream>
using namespace std;
class Number {
    int i;
public:
    Number(int ii = 0) : i(ii) {}
    const Number operator +(const Number& n) const
{
  cout<<i<<"+"<<n.i<<"="<<i+n.i<< endl;
  return Number(i + n.i);
}
friend const Number operator -(const Number&, const
Number&);
};
const Number operator-(const Number& n1,
    const Number& n2) {
    cout << n1.i - n2.i << endl;
    return Number(n1.i - n2.i);
}
int main() {
    Number a(47), b(11);
    a + b;
    a + 1;
    1 + a;
    a - b;
    a - 1;
    1 - a;
}
```

Name _Himanshu Dixit_   Enrollment No. _21103262_

Jaypee Institute of Information Technology, Noida

End-Term Examination, Even 2021-2022
B.Tech. II Semester

Course Title: Mathematics-2
Course Code: 15B11MA211

Maximum Time: 2 Hrs
Maximum Marks: 35

C106.1 Apply different methods for solving ordinary differential equations of second order.
C106.2 Explain different tests/methods of convergence for infinite series.
C106.3 Find the series solution of differential equations and use it to construct Legendre's polynomials and Bessel's functions.
C106.4 Classify the partial differential equations and apply Fourier series to find their solution.
C106.5 Explain Taylor's and Laurent's series expansion, singularities, residues and transformations
C106.6 Apply the concept of complex variables to solve the problems of complex differentiation and integrations.

Note: All questions are compulsory.

Q1. [CO1, 3M] Solve the following differential equation by changing the independent variable:
$$y'' - (\cot x)y' - (\sin^2 x)y = 0.$$

Q2. [CO2, 3M] Test the absolute convergence of the following series: $\sum_{n=0}^{\infty} \dfrac{(-1)^n \sqrt{n^2+1}}{n^2+n+8}$.

Q3. [CO3, 3M] Find the series solution of the following differential equation: $y'' - xy = 0$. $x=0$

Q4. [CO4, 4M] If both the ends of a bar of length 10 cm are at temperature zero and the initial temperature is given by $u(x,0) = 6\sin 2\pi x$ in the bar then find the temperature $u(x,t)$.

Q5. [CO5, 4M] Evaluate the integral $\displaystyle\int_0^{2\pi} \dfrac{d\theta}{5 - 3\cos\theta}$ using Cauchy's residue theorem.

Q6. [CO5, 4M] Expand $\dfrac{1}{(z+1)(z+3)}$ in a Taylor's or Laurent's series in the region

(i) $|z| < 1$ (ii) $1 < |z| < 3$ (iii) $1 < |z+1| < 2$.

Q7. [CO5, 2M] Find the fixed points of the bilinear transformation, $w = \dfrac{z}{z-2}$.

Q8. [CO6, 3M] If $u(x,y) = e^x(x\cos y - y\sin y)$ is a harmonic function, find an analytic function $f(z) = u + iv$ using Milne's Thomson method.

Q9. [CO6, 5M] Show that the function $f(z)$ defined by $f(z) = \begin{cases} \dfrac{(x^3 + xy)(x+iy)}{x^2 + y^2}; & z \neq 0 \\ 0; & z = 0 \end{cases}$

is not analytic at the origin even though it satisfies CR equations at the origin.

Q10. [CO6, 4M] Evaluate $\displaystyle\int_c \dfrac{z-3}{(z+1)^2(z-2)} dz$ where $C: |z-i| = 3$ using Cauchy's integral formula.