PDPM IIITDM Jabalpur
Mid Semester Examination (February 2024)
HS1002 - Indian Culture, Ethics and Human Values

Branch: BTech/BDes
Semester: II

Duration: 2 hours
Max. Marks: 20

Note: All the questions are compulsory.

Answer all the questions (400 words). **(5x4=20)**

1. "What one consumes, they produce in accord to it". Substantiate your views and reflections to explain in relevance to this context.
2. "Had it not been for these horrible demons, human society would be far more advanced than it is now". Elucidate it.
3. "When he cannot carry a needle, how will he carry the hoarded crores of rupees to the other world". Justify your views to this context.
4. "I cannot produce the beauty of my guru's songs ". Discuss in detail.
5. What are the 'The Four Secrets' for creating a World-Class Culture? What is your understanding on Tristan's philiosophy.

Course Instructor

→ NS1004 → AKK
→ ES1002 → PS
→ NS103a → DM
→ HS1002 → JAMF

PDPM IIITDM Jabalpur
End Semester Examination (April 2024)
HS1002 - Indian Culture, Ethics and Human Values

Branch: BTech/ECE, ME, SM & Design
Semester: II

Duration: 3 hours
Max. Marks: 40

Note: All the questions are compulsory.

Answer all the questions (600 words). **(5x8=40)**

1. "The extreme forms in which my passion for self-help and simplicity ultimately expressed itself will be described in their proper place". Illuminate the views of Gandhi and justify how far his philosophy is relevant even today.

2. "It is fitting that at this solemn moment we take the pledge of dedication to the service of India and her people and to the still larger cause of humanity". Discuss the views of Nehru and portray how his views are relevant and to be followed even today.

3. "Studies serve for delight, for ornament, and for ability. Their chief use for delight, is in privateness and retiring; for ornament, is in discourse; and for ability, is in the judgment, and disposition of business". Elucidate how Bacon justifies the value of study and how far are you able to follow his ideas in your own studies.

4. "Their chief use for delight, is in privateness and retiring; for ornament, is in discourse; and for ability, is in the judgment, and disposition of business". Describe the fatal moment of the protagonist and how he is able to win the confidence of the customer.

5. "He spit on the master's face and threw dust at him. His various humiliating acts meant to disturb the old master's mental equilibrium." Describe how perseverance leads to challenge and integrates one's strength to win the situation.

PDPM Indian Institute of Information Technology, Design & Manufacturing Jabalpur

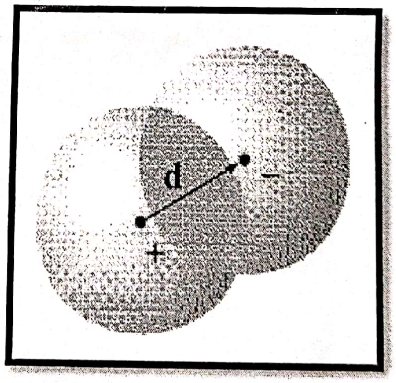
Electrodynamics & Optics (NS-1004)
Section C_ QUIZ 1

Time: 40 minutes *Full marks: 10* *30-01-2024*

1. The electrostatic field in cylindrical coordinate system is given as $\mathbf{E} = 10\sin^2\phi\,\mathbf{E}_r + r\,\mathbf{E}_\phi + (Z^2/r)\cos^2\phi\,\mathbf{E}_z$. Find the divergence of electric field value at a point P $(\rho, \varphi, z) = \left(2, \frac{\pi}{2}, 0\right)$. [2]

2. State and Prove uniqueness theorems in electrostatics. [5]

3. Two spheres, each of radius '**R**' and carrying uniform volume charge density +ρ & -ρ, respectively, are placed so that they partially overlap (**d** is vector see figure below). Find the electric field in the region of overlap. [3]



NS 1004: Electrodynamics & Optics

Date: 05/04/2024

SECTION-C

QUIZ -2 ***MARKS-10*** ***TIME-45 MINUTES***

Q.1. (a) Define Poynting's theorem. (b) Derive the Poynting Vector for light wave. **[1+4]**

Q.2. *Find the polarization "**P**" in a dielectric material with "*$\varepsilon_r = 2.8$*" if* $\boldsymbol{D} = 3.0x10^{-7}\ \boldsymbol{a}\ \mathrm{C/m^2}$. **[2]**

Q.3. *Find the magnetic field at a perpendicular distance "d" from a long straight wire carrying a steady current "I".* **[3]**

PDPM Indian Institute of Information Technology, Design & Manufacturing Jabalpur

MID Semester (NS-1004: Section C)

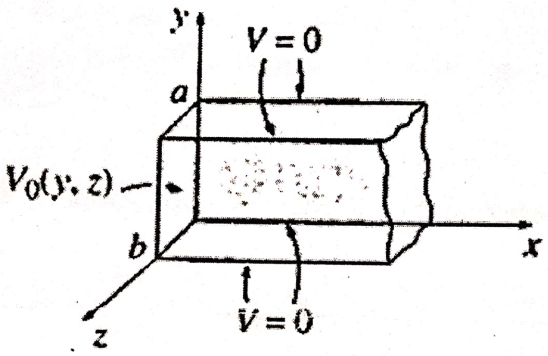
Electrodynamics & Optics

- Draw diagrams wherever necessary.
- Do Not skip any steps.

Marks- 20
Time– 2 Hours
29-02-2024

1. Evaluate the energy of a continuous charge distribution (with volume charge density ρ, that produces an electric field E). [3]

2. An infinitely long rectangular metal pipe (sides a & b) is grounded, but one end, at $x = 0$, is maintained at a specific potential $V_0(y, z)$ as shown figure below. Find the potential inside the metal pipe. [5]



3. In a cylindrical conductor of radius 2mm, the current density varies with the distance from the axis according to J = 1000 exp (-400R) A/m^2. Find the total current I. [3]

4. Write down the boundary conditions in magnetostatics for magnetic field and vector potential. [3]

5. What current density would produce the vector potential, $\mathbf{A} = k\hat{\varphi}$ (k is constant), in cylindrical coordinate? [3]

6. Establish the **Neumann formula** for electromagnetic inductance. [3]

Electrodynamics & Optics

NS 1004: SECTION-C

Date:30/04/2024 *MARKS-30* *TIME- 3 hours*

Instructions: 1. Draw diagram wherever necessary 2. Calculator is allowed

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Q.1. For a monochromatic plane electromagnetic (EM) wave, prove that the electric (E) and magnetic (B) fields are in phase and perpendicular to each other. [5]

Q.2. Envision a plane EM wave propagating in space along the Y-axis. If the E-field is linearly polarized in the Y-Z plane and wavelength is 500nm, write an expression for the corresponding B-field when the irradiance is 53.2 W/m^2. [3]

Q.3. Define standing wave and establish the nodes and maximum value positions. [1+3]

Q.4. Locate via β (known for single slit) both the minima and subsidiary maxima in the far field diffraction pattern. [4]

Q.5. Determine the grating equation considering diffraction from many slits. [4]

Q.6. (a) Write down four applications of Newton's ring experiment? [2]
(b) Newton's rings are formed between the curve and flat surfaces. If the 10th bright ring of light (546.1nm) is 7.89mm in diameter, what is the radius of curvature of the lens surface? [3]

Q.7. (a) Describe the important properties of LASER beam. [2]
(b) Determine the color & wavelength of a LASER light (in free space), having induced emission energy of 2 eV. [3]

$B = \frac{k}{\omega}(\hat{z} \times \vec{E})$

$E = \frac{\omega B}{k}$ $\omega = kc$

$\omega B_y = k E_x$

Quiz-1
NS103a: ODE and PDE

Time: 1 hour Max. Marks: 15

- *All questions are compulsory and weightage of each question is given with that.*
- *Start each question from new page and write every step for proper evaluation.*

1. Solve

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

[4]

2. Solve

$$(D^2 - 4D + 3)y = \sin 2x \cos x$$

[4]

3. Define with example [1+1+1=3]

   (a) General solution of a differential equation.

   (b) Particular solution of a differential equation.

   (c) Homogeneous differential equation.

4. Solve

$$x\cos(\frac{y}{x})(ydx + xdy) = y\sin(\frac{y}{x})(xdy - ydx)$$

[4]

Quiz-2
NS103a: ODE and PDE - Batch C
Course Instructor- DM

Max. Marks: 15

Time: 1 hour

- *All questions are compulsory and weightage of each question is given with that.*

1. Find the orthogonal trajectories of the following curves: [5]

$$\frac{x^2}{a^2+\lambda}+\frac{y^2}{b^2+\lambda}=1, \text{ where } \lambda \text{ is a parameter of the family of curves.}$$

2. Find $\mathcal{L}^{-1}\left[\frac{s^2+2s+5}{(s-1)(s-2)(s-3)}\right]$, where $\mathcal{L}^{-1}$ denotes the inverse Laplace transform. [3]

3. Solve the following initial value problem. [3]

$$4y'' - 8y' + 3y = \sin t, y(0) = 0, y'(0) = 2$$

4. Find $\mathcal{L}\{e^{(a+ib)t}\}$. Hence, show that [4]

$$\mathcal{L}[e^{at}\cos bt] = \frac{s-a}{(s-a)^2+b^2}, \quad \mathcal{L}[e^{at}\sin bt] = \frac{b}{(s-a)^2+b^2},$$

where $\mathcal{L}$ denotes the Laplace transform.

Mid-Semester Exam
NS103a: ODE and PDE - Batch C
Course Instructor- DM

Time: 2 hour Max. Marks: 30

- *All questions are compulsory and weightage of each question is given with that.*

1. Solve

$$x(1-x^2)dy + (2x^2y - y - ax^3)dx = 0, \quad \text{where } a \text{ is a positive number.}$$

[4]

2. Solve

$$\frac{d^2y}{dx^2} + a^2y = \sec ax, \quad \text{where } a \text{ is a positive number.}$$

[4]

3. Solve

$$(2+3x)^2\frac{d^2y}{dx^2} + 3(2+3x)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1$$

[4]

4. Solve

$$\frac{d^2y}{dx^2} + y = e^{-x} + \cos x + x^3 + e^x \sin x$$

[4]

5. Solve by the method of variation of parameters:

$$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = x^2e^x$$

[4]

6. Solve

$$(D^4 + D^2 + 1)y = ax^2 + be^{-x}\sin 2x, \quad \text{where } a \text{ and } b \text{ are positive numbers.}$$

[5]

7. Solve the differential equation

$$\frac{d^2x}{dt^2} + 2n\cos\alpha\frac{dx}{dt} + n^2x = a\cos nt$$

given that $x = 0$ and $\frac{dx}{dt} = 0$, when $t = 0$. Here n, a and α are positive numbers.

[5]

End-Semester Exam
NS103a: ODE and PDE - Batch C
Course Instructor- DM

Time: 3 hour

Max. Marks: 40

- *All questions are compulsory and weightage of each question is given with that.*

1. Classify the following equation and solve it:

$$2\frac{\partial^2 z}{\partial x^2} + 5\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = 0.$$

[2]

2. Find the partial differential equation by eliminating the arbitrary functions from the following relation: [3]

$$y = f(x - at) + xf(x - at) + x^2\phi(x - at).$$

3. Solve:

$$\left(\frac{d^2y}{dx^2} + a^2\right)^2 y = \frac{1}{2}\sin^2 ax.$$

[4]

4. Use the Laplace transforms to solve the following initial value problem. [4]

$$y'' + 5y' + 4y = e^{3t}, y(0) = 0, y'(0) = 3$$

$e^n = \frac{n!}{s^{n+1}}$

5. Find the inverse Laplace transform of the following function:

$$\frac{3}{s^2(s^2+4)(s^2+1)}$$

[4]

6. Solve:

$$\frac{d^2y}{dx^2} + 2y = x^2e^{3x} + e^x \cos 2x.$$

[4]

7. Solve:

$$\frac{\partial^3 z}{\partial x^2 \partial y} - 2\frac{\partial^3 z}{\partial x \partial y^2} + \frac{\partial^3 z}{\partial y^3} = \frac{1}{x^2}.$$

[4]

8. Obtain Fourier series of the function $f(x)$ which is defined as follows: [5]

$$f(x) = \begin{cases} 0, & -\pi \leq x < -\frac{\pi}{2}; f(-\frac{\pi}{2}) = -\frac{\pi}{4}; \\ x, & -\frac{\pi}{2} < x < \frac{\pi}{2}; f(\frac{\pi}{2}) = \frac{\pi}{4}; \\ 0, & \frac{\pi}{2} < x \leq \pi. \end{cases}$$

9. Solve by Lagrange's method:

$$(x^2 + y^2 + yz)\frac{\partial z}{\partial x} + (x^2 + y^2 - xz)\frac{\partial z}{\partial y} = z(x + y).$$

[5]

10. Solve by Charpit's method:

$$2xz - px^2 - 2qxy + pq = 0.$$

[5]

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PDPM Indian Institute of Information Technology Design & Manufacturing, Jabalpur

Mid Sem Examination (Feb 2024)

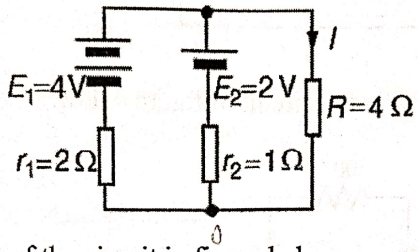
ES1002 - Fundamentals of Electrical and Electronics Engineering, Sem. – II

Time: 2 Hours | Maximum Marks: 25

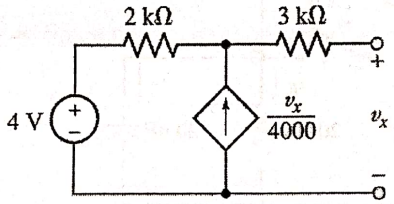
Instructions.

1) All questions are compulsory.
2) Attempt all parts of a question at one place otherwise it will not be evaluated.
3) Do not write anything on question paper except roll no.

1. Determine the current 'I', flowing in the 4 Ω resistor shown in figure below using Thevenin's theorem. Find also the power dissipated in the 4 Ω resistor. (2)

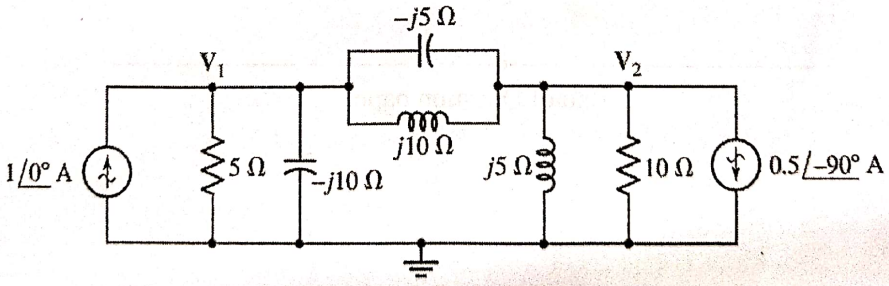


2. Determine the Thevenin equivalent of the circuit in figure below. (2)



3. A coil of inductance 159.2 mH and resistance 20 Ω is connected in series with a 60 Ω resistor to a 240 V, 50 Hz supply. Determine
   (i) the impedance of the circuit,
   (ii) the current in the circuit,
   (iii) the circuit phase angle,
   (iv) Draw the circuit phasor diagram showing all voltages. (3)

4. Use superposition to find V_1 for the circuit of figure below.



(3)

5. A coil of resistance 5 Ω and inductance 120 mH in series with a 100 μF capacitor, is connected to a 300 V, 50 Hz supply. Calculate
   (i) the current flowing,
   (ii) the phase difference between the supply voltage and current,
   (iii) the voltage across the coil and
   (iv) the voltage across the capacitor. (3)

Roll No.....

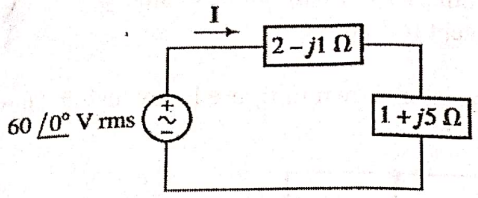
ich is defined as f

6. A coil of negligible resistance and inductance 100 mH is connected in series with a capacitance of 2 μF and a resistance of 10 Ω across a 50 V, variable frequency supply. Determine
(a) the resonant frequency,
(b) the current at resonance,
(c) the voltages across the coil and the capacitor at resonance, and
(d) the Q-factor of the circuit. (3)

$xz)\frac{\partial z}{\partial y} = z(x +$

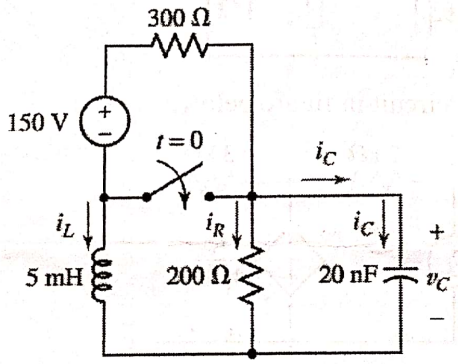
7. Calculate values for the average power delivered to each of the two loads shown in figure below, the apparent power supplied by the source, and the power factor of the combined loads.

$pq = 0.$



(3)

8. Find an expression for $v_C(t)$ valid for $t > 0$ in the circuit of figure below.



(3)

9. A capacitor is charged to 100 V and then discharged through a 50 kΩ resistor. If the time constant of the circuit is 0.8 s, determine:
(a) the value of the capacitor,
(b) the time for the capacitor voltage to fall to 20 V,
(c) the current flowing when the capacitor has been discharging for 0.5 s, and
(d) the voltage drop across the resistor when the capacitor has been discharging for one second. (3)

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End of Question paper

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PDPM Indian Institute of Information Technology Design & Manufacturing, Jabalpur

End Sem Examination (May 2024)

ES1002 - Fundamentals of Electrical and Electronics Engineering, Sem. – II

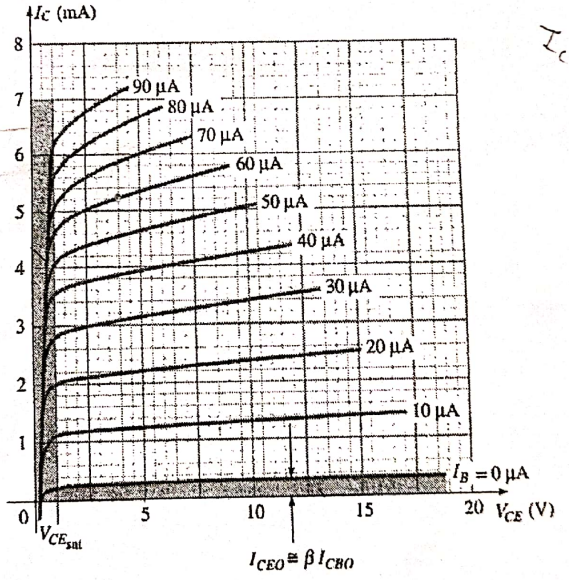
Time: 3 Hours **(Section C + D1)** Maximum Marks: 35

Instructions: 1. All questions are compulsory.
2. All the symbols have their usual meanings.
3. Attempt all sections of a question together, otherwise it will not be evaluated.

1. i). Define rms, average and form factor of a sinusoidal alternating voltage. (2+1+1+2)
ii) What do you mean by mutual inductance.
iii) Compare magnetic and electric circuits.
iv) Differentiate LED, Solar Cell, and Photodetector.

2. i) A flux of 400 μWb passing through a 150-turn coil is reversed in 40 ms. Find the average e.m.f. induced. (1)
ii)A flux of 25 mWb links with a 1500 turn coil when a current of 3 A passes through the coil. Calculate (2)
(a) the inductance of the coil,
(b) the energy stored in the magnetic field, and
(c) the average e.m.f. induced if the current falls to zero in 150 ms.

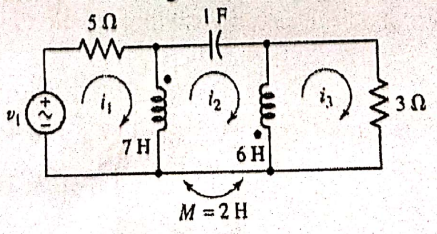
3. i) Using the characteristics of figure below, determine β_{dc} at (2)
(a) $I_B = 60\ \mu A$ and $V_{CE} = 4\ V$, **(b)** $I_B = 10\ \mu A$ and $V_{CE} = 10\ V$.



ii) Given that $I_E = 2.5$ mA, $h_{fe} = 140$, $h_{oe} = 20\ \mu S$ and $h_{ob} = 0.5\ \mu S$, determine the common-emitter hybrid equivalent circuit. (2)

iii) Discuss the hybrid equivalent model of BJT with suitable diagrams and equations. (3)

4. Write the phasor loop equations for the circuit in figure below. (3)



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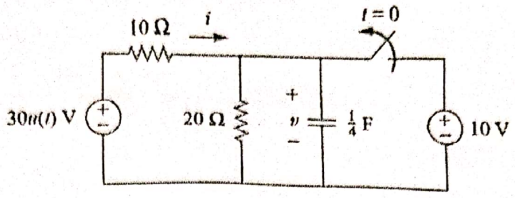
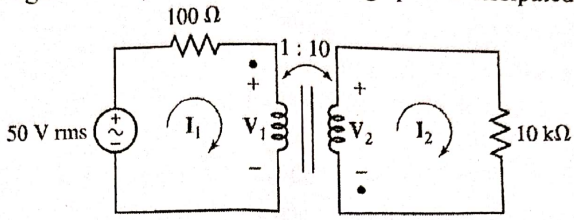
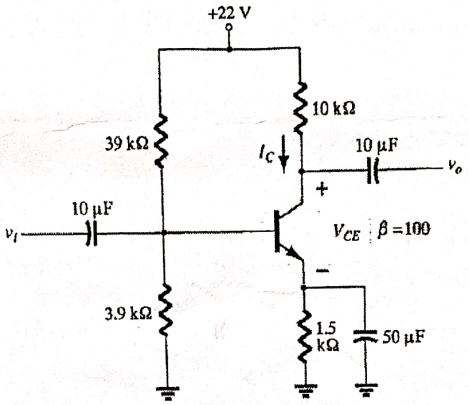
5. In the figure given below, the switch has been closed for a long time and is opened at $t = 0$. Find i and v for all time. (3)



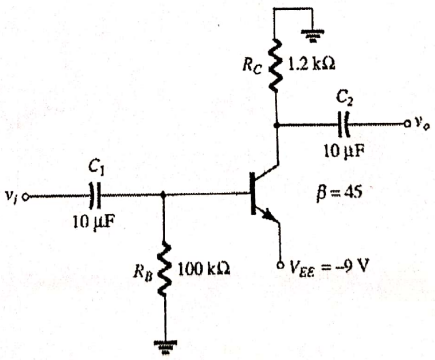
6. For the transformer circuit in figure below, determine the average power dissipated in the 10 k resistor (2)



7. Determine the dc bias voltage V_{CE} and the current I_C for the voltage divider configuration of figure below. (3)



8. Determine V_C and V_B for the network of figure below. (3)



9. i) Explain the principle and construction of a DC generator with neat sketch. Write its EMF equation. (3)
   ii) Explain the operation of a bridge rectifier with the help of circuit diagram and waveforms. (2)

**********End of Question Paper**********