UPES

UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Examination, July 2020

Programme:	**Semester :**
Course Name:	**Max. Marks : 100**
Course Code:	**Attempt Duration : 3 Hrs.**
No. of page/s:	

Note:

1. Read the instruction carefully before attempting.
2. This question paper has two section, Section A and Section B.
3. **Section A** consist of 30 multiple choice based questions and has the total weightage of 60 marks.
   (6 Questions x 4M, 6 Questions x 3M, 18 Questions x 1M)

4. **Section A** will be conducted online on BB Collaborate platform
5. **Section B** consist of long answer based questions and has the total weightage of 40 marks. The questions for section B shall also appear in BB Collaborate
6. The maximum time allocated to **Section A** is 1.5 Hr.
7. **Section B** is to be submitted within 24 hrs from the scheduled time i.e. if the examination starts at 10:00 AM, the long answers must be submitted by 09:59:59 AM next day. Similarly, if the examination starts at 2:00 PM it must be submitted by 01:59:59 PM next day. (*Exceptional provision due extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
8. No submission of **Section B** shall be entertained after 24 Hrs.
9. **Section B** should be attempted after **Section A**
10. **Section B** should be attempted on blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sap id at the top (as in the format) and signature at the bottom (right hand side bottom corner)
11. Both section A & B should have questions from entire syllabus.
12. The COs mapping, internal choices within a section is same as earlier

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Section – A (Attempt all the questions)

1. Multiple Choice: Q 1.: CO3 Two batteries of emfs 6 V and 2 ...

Points: 4

Question	CO3
	Two batteries of emfs 6 V and 2 V having internal resistances of 2 Ω and 3 Ω, respectively are connected in parallel across a 5 Ω resistance. Calculate the voltage across 5 Ω resistance-
Answer	✓ 3.55 V
	Infinite
	0.5 V
	None of the above

2. Multiple Choice: Q 2.: CO3 A sinusoidal voltage of 230 V is...

Points: 4

Question	CO3
	A sinusoidal voltage of 2 0 V is applied across a series RL circuit.
	It is found that the power dissipated is 3200 W and the current is given by the equation
	$i = 28.28 \sin(315t — θ)$. Find the value of inductance (L) used in the of the circuit
Answer	2.6 H
	0
	✓ 0.026 H

none of the above

3. Multiple Choice: Q 3: CO4 Two coils A and B consisting of ...

Points: **4**

Question	CO4
	Two coils A and B consisting of 100 and 500 turns respectively are w ound side by side on a closed iron circuit of section 100 crn^2 and mean length 200 cm. If the permeability of iron is 3000; find the emf induced in coil B if the current in coil A changes uniformly from 0 to 20 A in 0.02 second.
Answer	335 volts
	942 volts
	1219 volts
	None of the above

4. Multiple Choice: Q 4: co$ A parallel plate cap...

Points: **4**

Question	co$
	A parallel plate capacitor has circular plates of radius R = 5.0 cm. While charging, the electric field increases at the rate of . The displacement current would be-
Answer	2.5 x 10^{-4} mA
	✓

✓ 70 mA

0

None of the above

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5. Multiple Choice: Q 5: CO3 The R-L-C circuit has inductance...

Points: 4

Question

CO3

The R-L-C circuit has inductance of 12 mH and resistance of 3 ohms. What is the value of capacitance that will produce resonance frequency of 9000 Hz?

Answer

0.0026 microfarad

0.0026 picofarad

✓ 0.026 microfarad

None of the above

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6. Multiple Choice: Q 6: CO1 You are given three point charge...

Points: 4

Question

CO1

You are given three point charges q_1, q_2 and q_3. When q_1 and q_2 are placed together to form a single point charge, the force on q_3, at distance L from this combination is a repulsion of 2 units magnitude. When q_3 and q_1, are so combined, the force on q_2 at the same distance L is an attraction of 18 units and when q_2 and q_3 are combined the force on q_1 at distance L is an attraction of 4 units. The ratio $q_1:q_2:q_3$ will be-

Answer

-3:1:4

✅ 4:-3:2

3:3:2

None of the above

☐ **7. Multiple Choice: Q 7: CO4**   Points: **3**

Question   CO4

Which of the following is correct for a capacitor?

(a) $W = \dfrac{1}{2}\dfrac{Q^2}{C}$ (b) $W = \dfrac{1}{2}CI^2$

(c) $W = \dfrac{1}{2}VC^2$ (d) $W = \dfrac{1}{2}CV^2$

Answer   a

b

c

✅ d

8. Multiple Choice: Q 8: CO2 The maximum value of permeabilit...

Points: 3

Question	CO2
	The maximum value of permeability of a material is 0.126 N/A^2 The susceptibility will be –

Answer	✓ 99999
	100001
	-100001
	None of the above

9. Multiple Choice: Q 9: CO4 A parallel plate capacitor has p...

Points: 3

Question	CO4
	A parallel plate capacitor has plate area A, Separated by a distance d, and contains dielectric of permittivity ε. When a voltage $V_0 Sin\omega t$, is applied to its plate, the magnitude of displacement current J_D and Conduction current J_C are –

Answer	$J_D > J_C$
	$J_D < J_C$

✓ $J_D = J_C$

$J_D = 0$

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10. Multiple Choice: Q 10: CO3 A coil of 100 turns is lin...

Points: 3

Question	CO3
	A coil of 100 turns is linked with a flux of 0.01 Wb when carrying current of 10 A. Calculate the induced e.m.f, if this current is reversed in 0.01 seconds

Answer	300 V
✓	200 V
	400 V
	None

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11. Multiple Choice: Q 11: CO4

Points: 3

Question

CO4

The magnetic flux density at the end of a one-metre-long solenoid carrying current of I amp and having N turn will be

(a) $\mu\,NI$

(b) $\dfrac{\mu\,NI}{\sqrt{4R^2+I^2}}$

(c) $\dfrac{\mu\,NI}{2}$

(d) $\dfrac{\mu\,NI}{\sqrt{R^2+I^2}}$

Answer	
	a
	b
✓	c
	d

□ **12. Multiple Choice: Q 12:CO2**

Points: 3

Question   CO2

By inserting a plate of a dielectric material between the plates of a parallel plate capacitor, the energy (stored) is increased five times. The dielectric constant of the material is

(a) 1/25   (b) 1/5

(c) 5   (d) 25

Answer	
	a
	b
✓	c
	d

13. Multiple Choice: Q 13: CO1 Gauss's divergence theorem is us...

Points: 1

Question	CO1
	Gauss's divergence theorem is used to transfmm:

Answer	✅ a volume integral into is used surface integral
	a line integral into surface integral
	volume integral to line integral
	none of the above

14. Multiple Choice: Q 14: CO2 By induction we produce

Points: 1

Question	CO2
	By induction we produce

Answer	equal charges
	equal and like charges

✅ equal and opposite charges

unequal and similar charges.

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15. Multiple Choice: Q 15: CO4 The force of attraction or repul...   Points: 1

Question	CO4
	The force of attraction or repulsion between charges follows

Answer	square law
	✅ inverse square law
	both (a) and (b)
	none of (a) and (b)

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16. Multiple Choice: Q 16: CO2 Two charges q1 and q2 are placed...   Points: 1

Question

CO2

Two charges q_1 and q_2 are placed close to each other; if a third charge q_3 is brought near it, the force exerted by q_1 on q_2 now

Answer

Increases

decreases

✅ remains the same

reduces to practically zero.

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17. **Multiple Choice: Q 17: CO2 Electric field intensity due to ...**

Points: 1

Question

CO2

Electric field intensity due to a point charge—

Answer

Falls inversely proportional to the distance

✅ Falls inversely proportional to the square of the distance

Falls inversely proportional to the square root of the distance

It does not change with distance.

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18. **Multiple Choice: Q 18: CO1 Which of the following is a vect...**

Points: **1**

Question	CO1
	Which of the following is a vector field ?

Answer	distribution of temperature
	magetic and electrostatics potentials
	density of any non-dilected quantity in a given region of space
✅	the distribution of electric or magnetic field intensity

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19. **Multiple Choice: Q 19: CO2 The electric field intensity of ...**

Points: **1**

Question	CO2
	The electric field intensity of an infinite long charge line varies

Answer	Inversely proportional to the square of the distance from it

✅ Inversely proportional to the distance from it

Inversely proportional to the square root of the distance from it.

It remains constant.

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20. Multiple Choice: Q 20: CO1 The dimensions of potential are ...

Points: 1

Question	CO1
	The dimensions of potential are same as that of

Answer	work
	electric field per unit charge
	✅ work per unit charge
	force per unit charge

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21. Multiple Choice: Q 21: CO1 Electric field fines and equipot...

Points: 1

Question

CO1

Electric field fines and equipotential lines are

Answer	✓ always orthogonal
	orthogonal only when electric field is uniform
	orthogonal only when potential does not change
	none of the above is correct.

22. Multiple Choice: Q 22: CO1 Electric field potential due to ...

Question	CO1
	Electric field potential due to a point charge
Answer	✓ falls inversely proportional to the distance
	falls inversely proportional to the square of the distance
	falls inversely pmportional to the square root of the distance
	it does not change with distance

23. Multiple Choice: Q 23: CO2 The electric dipole moment (P) i...   Points: 1

Question	CO2
	The electric dipole moment (P) is a vector, it points

Answer	from positive to negative charge
	✅ from negative to positive charge.

24. Multiple Choice: Q 24: CO1 The paramagnetic materials have ...   Points: 1

Question	CO1
	The paramagnetic materials have a permanent net magnetic moment per atom because of
Answer	paired electrons
	✅ unpaired electrons
	both paired and unpaired electrons
	neither paired not unpaired electrons

25. Multiple Choice: Q 25: CO4 Two parallel wires carry current...   Points: 1

Question	

CO4

Two parallel wires carry current along opposite directions. The resultant force experienced by the two wires is-

Answer

zero.

attractive

✓ repulsive

none of the above.

☐ 26. **Multiple Choice: Q 26:CO3**

Points: 1

Question

CO3

Quality factor Q of a coil is

(a) $Q = \dfrac{\omega L}{R}$

(b) $Q = \omega LR$

(c) $Q = \dfrac{R}{\omega L}$

(d) $Q = \dfrac{1}{\omega LR}$

Answer

✓ a

b

c

d

27. Multiple Choice: Q 27: CO1

Points: 1

Question	CO1
	Poisson's equation states that

(a) $\nabla^2 V = -\dfrac{\rho}{\varepsilon}$ (b) $\nabla^2 V = \dfrac{\rho}{\varepsilon}$

(c) $\nabla V = \dfrac{\rho}{\varepsilon}$ (d) $\nabla V = \dfrac{\rho^2}{\varepsilon}$

Answer

✅ a

b

c

d

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28. Multiple Choice: Q 28: CO1

Points: 1

Question	CO1

$\nabla . \vec{D} = \rho$ is based on

(a) Ampere's law   (b) Faraday's law
(c) Ohm's law   (d) Gauss's law

Answer

a

b

c

✓ d

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29. **Multiple Choice: Q 29: CO4 A compass needle is placed near ...**   Points: 1

Question	CO4
	A compass needle is placed near a box and experiences deflection. The box does not have a magnet inside. It may have

Answer	
	a charge body inside
	capacitor fully inside
	✓ current carrying conductor
	none of these

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30. **Multiple Choice: Q 30: CO3 Magnetic flux density emerging o...**   Points: 1

Question	CO3
	Magnetic flux density emerging out of a closed surface is

Answer	
	infinite
	✓ zero

depends upon the magnetic movement inside the closed boundary

both (b) and (c) are correct

PART B

1- CO1

For a position vector $r = ix + jy + kz$, find the values of (i) grad $(1/r)$ and (ii) grad r^m

[6 M]

2- CO2

Define Hysteresis loss in magnetic materials. The area of a hysteresis loop is 100m^2. Each unit space along the vertical axis represent 0.01 Wb/m^2 and each unit space along the horizontal axis represents 40A/m. Determine the hysteresis loss per cycle.   [6 M]

3- CO3

Calculate the value of load resistance R_L to which maximum power may be transferred from the circuit shown in the following figure. Also find the maximum power-
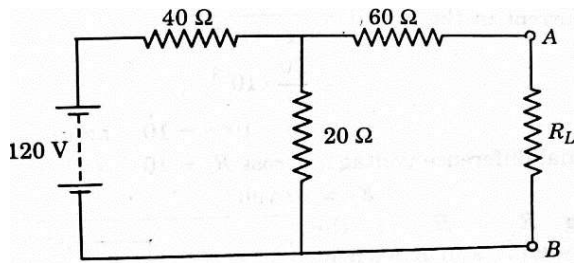
[5 M]

4- CO3

A series LCR circuit has L= 100 μH, C = 100 μF, and R = 0.1 Ω. Find the resonant frequency and the impedance of the circuit at this frequency. A voltage of 5 millivolts at the resonant frequency is applied to the circuit. Determine the resulting voltage across L. What is the impedance of the series circuit at a frequency less than the resonant frequency by 5000 cycles? **[6 M]**

5- CO4

Derive the electrostatic boundary conditions for a conductor-dielectric boundary. **[6 M]**

6- CO4

What are the various methods of measuring unknown capacitances? Discuss De-Sauty's bridge method.

[6 M]

7- CO3

A 20 volts 5 watts lamp is to be used on a. c. mains with 200 volts and 50 Hz. Calculate the (i) Capacitor, (ii) Inductor to be put in series to run the lamp. What value of pure resistance should be included in place of the above components so that the lamp can run on its rated voltage?

[5 M]