Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Electrical Engineering)

EE-4401 / EE-4301 ELECTROMAGNETIC FIELDS & MATERIALS

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Explain Divergence theorem and its applications. ***07***

(b) (i) Express the field $A = 2xyza_x - 5(x + y + x)a_z$ in cylindrical co-ordinate system ***07***
(ii) Find $|A|$ at $P(\rho = 2,\ \varphi = 60,\ z = 3)$

2(a) Derive the relationship between electric field and electric potential. ***07***

(b) Show that the field $F = (150/\rho^2)a_\rho + 10a_\varphi$ is rotational and non-solenoidal. ***07***

3(a) Derive Laplace and Poission's equations. ***07***

(b) Compare Conductors, insulators and semiconductors with their properties. ***07***

4(a) Discuss the behavior of dielectric materials when subjected to various frequencies. ***07***

(b) Derive an expression for capacitance of co-axial cable. ***07***

5(a) State and prove Ampere's circuital law and discuss any one application. ***07***

(b) What do you mean by magnetic hysteresis Explain hysteresis and eddy current losses? ***07***

6(a) Derive Maxwell's equations from Faraday's law. ***07***

(b) Derive the boundary condition for electric field. ***07***

7(a) Explain Poynting theorem and Poynting Vector. ***07***

(b) Derive the relation between E and H for a uniform plane wave in free space. ***07***

8 Write short notes on **any two** : ***14***

(i) Method of images
(ii) Hall Effect and Hysteresis
(iii) Polarization of wave
(iv) Band to band transitions of semiconducting materials

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Electrical Engineering)

EE-4402 / EE-4302 ELECTRICAL MACHINE - I

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Explain the essential conditions for electromechanical energy conversion process. ***04***

(b) Compare and contrast the electromechanical energy conversion process in singly excited system and doubly excited system. ***04***

(c) Prove that energy and co-energy in a linear magnetic system are given by identical expression. ***06***

2(a) Explain in a D.C. machine, how resistance commutation is achieved. ***04***

(b) In D.C. machines, explain why air gap length at pole center is short as compared to air gap lengths at pole tips. ***03***

(c) A 10 kW, 4 pole D.C. generator develops an e.m.f. of 220 at 1500 rpm. The armature has a lap connected winding. The average flux density over a pole pitch is 0.9 Tesla. The length and diameter of the armature are 0.25m and 0.2m respectively. Calculate : ***07***

(i) The flux per pole.
(ii) The total number of active conductors in the armature and
(iii) The torque developed by the machine when the armature supplies a current of 40A.

3(a) In the model of a D.C. machine, field winding and its armature circuit are always drawn at 90^{o} with respect to each other. Why? ***03***

(b) Why does the terminal voltage fall more rapidly in a self excited shunt generator then in a separately excited D.C. generator? ***04***

(c) A 4-pole compound generator has armature, series field and shunt field resistances of 1Ω, 0.5Ω and 100Ω respectively. This generator delivers 4 kW at a terminal voltage of 200 V, Allowing 1.0 V, per brush for contact drop, calculate for both short shunt and long shunt connections : ***07***

(i) The generated emf and
(ii) The flux per pole if the armature has 200 lap connected conductors and is driven at 750 rpm.

4(a) Describe, with a neat diagram, the working of a three point starter used for D.C. shunt motor. Why this starter cannot be used where wide range of speed control, by shunt field control is required? ***07***

(b) A 4-pole D.C. series motor has wave connected winding with 600 conductors. Total resistance of motor is 0.8 Ω. When fed from 250V D.C. source, the motor supplies a load of 10kW and takes 50A with flux per pole of 3 mwb. For these conditions, calculate the developed torque and shaft torque. ***07***

P.T.O.

5(a) Make approximate estimates, giving brief reasons, of the changes in the armature current and speed of a D.C. shunt motor when operating conditions are changed as described below : ***07***

(i) With load torque and field current held constant, the armature voltage is halved.
(ii) With the armature voltage and load torque held constant the field flux is halved.
(iii) With the torque held constant, both the armature voltage and field flux are halved.

(b) A 250V, D.C. shunt motor has an armature current of 20A when running at 1000 rpm against some load torque. The armature resistance is 0.5Ω and brush contact drop is one volt per brush. By how much must the main flux be reduced to raise the speed by 50% if the developed torque is constant? Ignore effects of armature reaction and magnetic saturation. ***07***

6(a) Explain how the primary current increase as the current on the secondary side of the transformer is increased. ***04***

(b) Draw the phasor diagram of a single phase transformer under unity power factor load. ***03***

(c) A 100 kVA, 2400/240 V, 50 Hz. Single phase transformer has an exciting current of 0.64A and a core loss of 700 Watts. When its high voltage side is energized at rated voltage and frequency. Calculate the two components of the exciting current. If the transformer supplies a load current of 40A at 0.8 power factor lag on its l.v. side, then calculate the primary current and its power factor. Ignore leakage impedance drops. ***07***

7(a) Describe, with a neat diagram the back to back test for calculating the efficiency of a single phase transformer. ***07***

(b) The efficiency of a 20 kVA, 2500/250V, single phase transformer at unity p.f. is 98% at rated load and at half rated load. Determine the transformer losses and the p.u. value of the equivalent resistance of the transformer. ***07***

8 Write short notes on the following : ***14***

(i) Single phase step down auto transformer.
(ii) Parallel operation of 3-phase transformers and load sharing.

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Electrical Engineering)

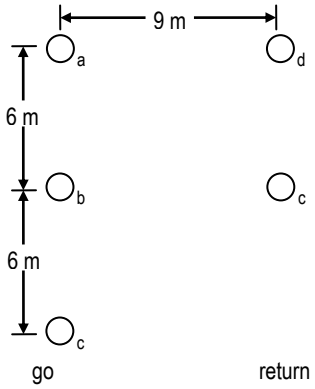
EE-4403 POWER SYSTEM - I

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) What is the purpose of a transmission system in a power network? State and explain the different types of transmission systems. ***07***

(b) Determine the inductance of a single-phase transmission line consisting of three conductors of 2.5 mm radius is the 'go' conductor and two conductors of 5 mm radius in the 'return' conductor. The configuration of the line is shown in *figure* below : ***07***



2(a) Compare the performance of single or stranded conductors versus bundled conductors based on key parameters i.e. : ***07***

(i) Electric field intensity (ii) Corona loss
(iii) Surge impedance (iv) Mechanical strength

(b) Explain the classification of transmission lines based on their length and voltage. Also, draw the corresponding equivalent circuit diagrams for each type. ***07***

3(a) What are ABCD constants in a transmission line? Explain their significance. ***07***

(b) A medium single-phase transmission line 110 km long has the following constraints : ***07***

- Resistance/km : 0.2 ohm
- Reactance/km : 0.64 ohm
- Susceptance/km : 1.5×10^{-6} mho
- Receiving end voltage : 66 kV

Assuming that the total capacitance of the line is located at the receiving end alone; determine :

(i) Sending end current, voltage and power factor
(ii) Percentage regulation
(iii) Line losses
(iv) Transmission efficiency

P.T.O.

4(a) Explain feeders, Kelvin's Law and the Modified Kelvin's Law. Also, write the limitations of Kelvin's Law. ***07***

(b) A two wire dc distributor AB, 600 m long is loaded as under : ***07***

Distance from A(m)	150	300	350	450
Loads (Ampere)	100	200	250	300

The feeding point A is maintained at 440 V and that of B at 430 V. If each conductor has a resistance of 0.01 ohm per 100 meters, calculate :

(i) the current supplied from A to B
(ii) the power dissipated in the distributor.

5(a) Discuss how voltage is distributed across a suspension insulator string. ***07***

(b) A 33 kV, 50 Hz, 3-phase underground cable, 4 km long uses three single core cables. Each of the conductor has a diameter of 2.5 cm and the radial thickness of insulation is 0.5 cm. Determine : ***07***

(i) Capacitance of cable/phase
(ii) Charging current/phase
(iii) Total charging kVAR

The relative permittivity of insulation is 3.

6(a) Discuss the methods of laying underground cables along with their advantages and disadvantages. ***07***

(b) In a 33 kV overhead line, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 11% of self-capacitance of each insulator, find : ***07***

(i) The distribution of voltage over three insulators
(ii) String efficiency.

7(a) Discuss the various types of poles and towers used in transmission lines. Also, state the properties of line supports. ***07***

(b) A transmission line has a span of 214 m between level supports. The conductors have a cross sectional area of 3.225 cm^2. Calculate the factor of safety under the following conditions : ***07***

Vertical sag = 2.35 m, Wind pressure = 1.5 kg/m (running),
Breaking stress = 2540 kg/cm^2, Weight of conductor = 1.125 kg/m (running).

8 Write short notes on **any two** : ***14***

(i) Corona in transmission lines
(ii) Methods to improve string efficiency
(iii) Skin effect and proximity effect
(iv) Sag template and string charts.

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Electrical Engineering)

EE-4404 /EE-4304 ELECTRICAL INSTRUMENTATION

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Draw the block diagram of a CRO and explain each block in detail. ***07***

(b) With a neat sketch explain the working of CRT. Draw the signal waveform which will appear on the screen if signal $y(t) = 20sin\omega t$ is applied on Y-plate and $x(t) = 20\sin(\omega t + 60°)$ applied on X-plate. ***07***

2(a) What are the various types of wave analyzers? Explain with applications. ***07***

(b) Discuss in detail about square and pulse generator with neat diagrams. ***07***

3(a) An electrically deflected cathode ray tube has anode voltage of 2000 volts and parallel deflecting plates 1.5 cm long and 5 mm apart. If the screen is 50 cm from the centre of deflecting plates, evaluate : ***07***

(i) Deflection sensitivity of the tube and (ii) Deflection factor of the CRT.

(b) What is an LVDT? Describe how it can be used for measurement of small displacement. ***07***

4(a) Explain with the help of a diagram the working of a function generator and how it generates triangular and square wave output waveforms. ***07***

(b) In a linear ramp type voltmeter the counter is driven by a 0.5 MHz clock and the value of the counter is 200 counts at the end of the measurement. If the ramp rate is 5 mV/ms then determine the unknown input voltage. ***07***

5(a) Discuss the working of strain gauge and derive the gauge factor. ***07***

(b) Explain the operation of sweep frequency generator with the help of a suitable block diagram. Mention its applications. ***07***

6(a) Explain how a single beam CRO can be used to measure the phase difference between two sinusoidal voltages of the same frequency. Does this measurement depend upon the relative sensitivities of X and Y deflection plates of the CRO. ***07***

(b) In electrical and electronic measurements show various advantages of digital instruments over analog instrument. ***07***

7(a) State the application of digital frequency meter and explain the working with the help of a suitable block diagram. ***07***

(b) Explain principle of operation and working of successive approximation type DVM. ***07***

8 Write short note on the following :

(i) Hall effect Transducers ***05***
(ii) Graphic Recorder ***05***
(iii) High frequency measurement ***04***

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Electrical Engineering)

EE-4405 DIGITAL ELECTRONICS & LOGIC DESIGN

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1 Do as directed :–

(a) Convert (420.6) to octal number. ***03***

(b) $(110111.1)_2 \div (101)_2$ ***03***

(c) Subtract $(372)_8$ from $(453)_8$ using 7's complement. ***04***

(d) Multiply 5AB × 7 ***04***

2(a) Why Ex-3 code is called self-complementing code? ***03***

(b) Convert decimal number 20 to gray code. ***03***

(c) Add 52 and 63 in BCD code. ***04***

(d) Encode the binary digit 1011 in 7-bit odd parity Hamming code. ***04***

3(a) Explain Ex-OR gate with truth table and logic diagram and realize it using NOR gates only. ***06***

(b) A truth table has 4-input variables A, B, C, D. For the first five combination (0 to 4) output is '1', for next five combination (5 to 9) output is '0' and for last six combination output is don't care. Write truth table and simplify using Karnaugh map. ***08***

4 Using Quine Mc-cluskey method obtain the minimal expression for the following function: ***14***

$$f = \Sigma m\,(2, 3, 6, 7, 8, 9, 13, 15)$$

5(a) Define a register. What is a shift register? Construct left-shift register using D-flip flop. ***07***

(b) Differentiate between S-R and J-K flip flop. Show how to convert a J-K flip flop into 'D' flip flop? ***07***

6(a) "Synchronous counter is faster than asynchronous counter." Justify this statement. ***04***

(b) Design a MOD-10 ripple counter using J-K flip flop. ***10***

7(a) Design a binary to gray code converter with logic circuit. ***07***

(b) Explain the terms multiplexing and demultiplexing. Draw the block diagram and explain 4 to 1 multiplexer. ***07***

8 Write short note on **any two** : ***14***

(i) Half adder and half subtractor (ii) RAM and ROM memories
(iii) Ring counter (iv) Decoder and encoder
(v) Characteristics of logic family

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