Registration No.: | | | | | | | | | | |

Total Number of Pages: 03 **Course: B.Tech/IDD**
Sub_Code: 23ES1001

1st Semester Regular/Back Examination: 2025-26
SUBJECT: BASIC ELECTRICAL ENGINEERING
BRANCH(S): AE, AEIE, AERO, AG, AI, AIML, AME, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSE(CS), CSEAI, CSEAIML, CSEDS, CSIT, CST, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ENV, ETC, IT, MANUTECH, MECH, METTA, MINING, MME, MMEAM, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.Code: U726

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What is meant by an ideal voltage and current sources?
b) A resistor of 12 ohm is connected in series with a combination of 15 Ω and 20 Ω resistor in parallel. When a voltage of 120 V is applied across the whole circuit. Find the current taken from the supply.
c) The equation of alternating current is $i = 42.4 \sin 628t$. Then find the average value of current.
d) Two waveforms have periods of $T_1 = 10$ ms and $T_2 = 50$ ms respectively. Which has the higher frequency? Compute the frequencies of both waveforms.
e) What happens to the power factor of a series R-L-C circuit when the frequency of the supply is varied above and below the resonant frequency?
f) If $Z_1 = 3 + j8$ and $Z_2 = 4 + j6$, then find (Z_1/Z_2).
g) A DC generator is found to develop an armature voltage of 220 V. If the flux is reduced by 25 % and speed is increased by 40 %, what will be the armature generated voltage?
h) What is the purpose of performing open circuit test and short circuit test on a single-phase transformer?
i) Name any two conventional and two non-conventional sources of electrical power.
j) What is the need for high-voltage transmission of electrical power?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Determine the voltage 'v' in the circuit shown in Figure 1. Use nodal analysis method.

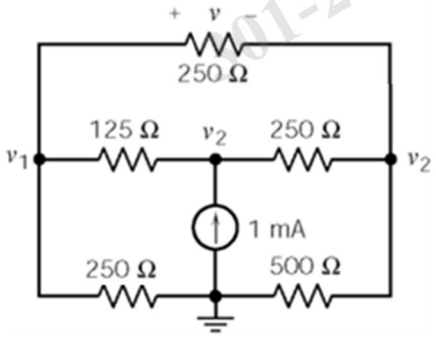

Figure 1

b) Describe with a neat diagram, the principle of operation of three phase induction generator.

c) Find the equivalent resistance between terminal a and b (R_{ab}) in the circuit shown in Figure 2.

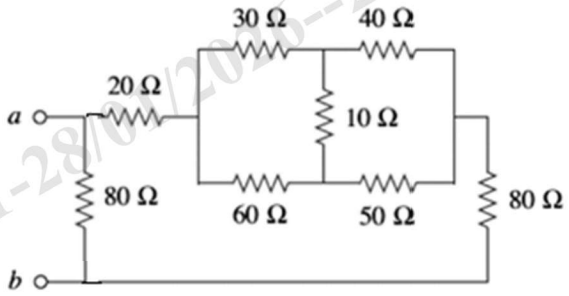

Figure 2

d) Find the form factor of the waveform as shown in Figure 3.

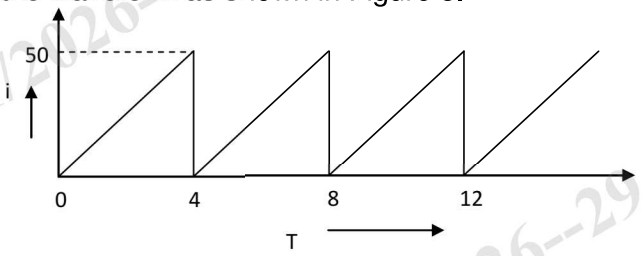

Figure 3

e) Explain the concept of resonance in series RLC circuit and derive the expression for resonance frequency. Also, plot the related curves.

f) Three equal star-connected inductors take 8 kW at a power factor 0.8 when connected across a 460 V, 50 Hz, 3-phase, 3-wire supply. Find the circuit constants of the load per phase.

g) Define the term magneto-motive-force (MMF), reluctance, permeance, and reluctivity. Also find those analogous electrical quantities.

h) Distinguish between self-excited and separately exited DC Generators. Give the circuit diagrams of Self excited DC Generators.

i) Explain speed control methods of a DC shunt motor. Draw the characteristic curves.

j) A three-phase induction motor run at a speed of 950 rpm at full load when supplied with power from a 50 Hz three phase line. The synchronous speed is 1000 rpm. Determine,

I. The number of poles of the motor.
II. What is the percentage slip at full load?
III. What is the corresponding frequency of rotor voltages?
IV. What is the rotor frequency at the slip of 10 percent?

k) Draw the layout of electric power supply system? Explain function of its elements.

l) With neat diagram explain the layout of hydro-electric power plant. What are the main components of hydroelectric power plant? Explain.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Derive EMF equation of a DC generator. **(8)**

b) A DC shunt generator gives an open circuit voltage of 240 V. When loaded, the terminal voltage falls to 220 V. Determine the load current in case armature-circuit and field-winding resistances are 0.1 Ω and 50 Ω respectively. **(8)**

Q4 What is DC motor? Derive its torque equation. Draw the speed-torque characteristics of DC shunt, series, and compound motors in one figure and compare them. Which characteristic is more suitable for traction purposes and why? **(16)**

Q5 State Thevenin's Theorem. Find current through R_L = 10 ohms of the network shown in Figure 4 using Thevenin's theorem? Also, find Norton's equivalent circuit. **(16)**

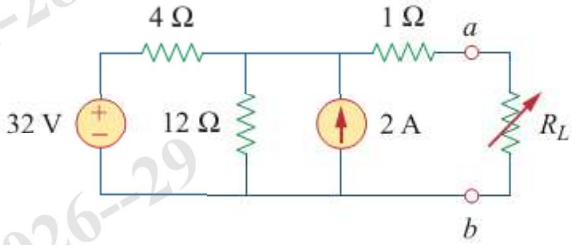

Figure 4

Q6 Discuss the working principle of a single-phase transformer. Also, draw the phasor diagram of a single-phase transformer on load (lagging, leading, and unity power factor cases) considering with winding resistance and leakage reactance. **(16)**