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Roll No.

SECOND SEMESTER

B.E. (COE/EC/EE)

MID SEM EXAMINATION

March 2007

COE/EC/EE-111 PRINCIPLES OF ELECTRICAL
ENGINEERING

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Question No. **ONE** is compulsory.
Answer any **THREE** questions from the rest.
Assume suitable missing data, if any.

1 Justify using proper reasons:

- [a] Voltage sources are short circuited and current sources open circuited for analysis of individual effect of each source. 1
- [b] Inductor behaves as short circuit and capacitor as open circuit when subjected to steady state dc sources. 1
- [c] Instantaneous power and current cannot be expressed on a same phasor diagram. 1
- [d] Square and triangular alternating waveforms/ source are generally not suitable as compared to sinusoidal source for ac circuit. 1
- [e] Inductance and capacitance are called wattless element, even when they draw current from ac mains. 1

- 2[a] For the circuit in Fig.1 calculate the value of load resistor R_L for which maximum power is transferred to the load resistor. Also, calculate the maximum power transferred. 2

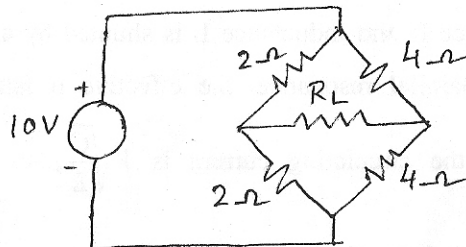


FIG 1 .

[b] Determine current drawn from V_s and voltage across I_s in Fig.2

3

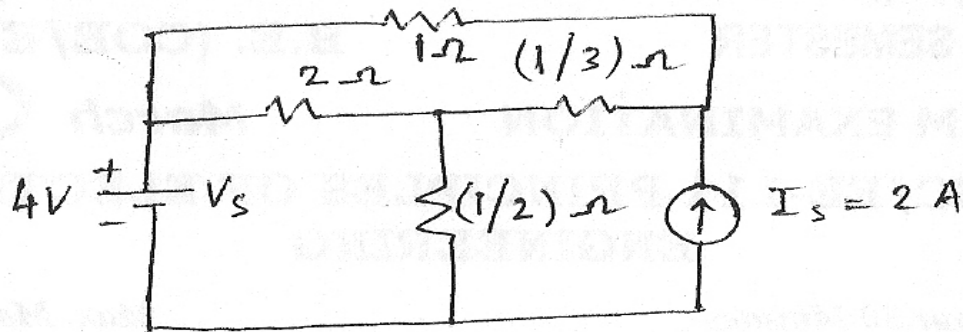


FIG. 2

3[a] Determine the current in the inductor of Fig.3.

3

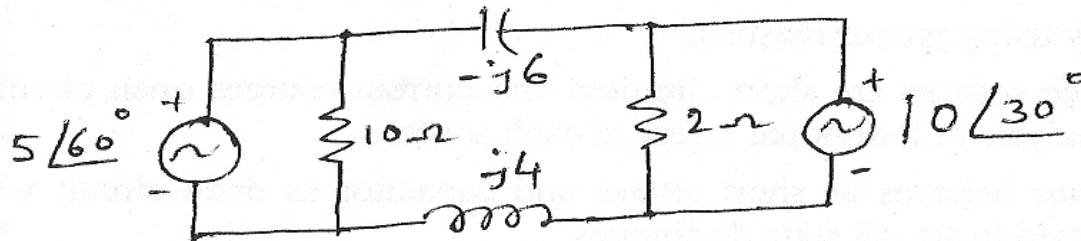


FIG. 3

[b] In the circuit of Fig.4 $v_s(t) = 100\sqrt{2}\cos(300t + 30^\circ)V$. Find $i_L(t)$, apparent, real, and reactive power consumed by the load.

2

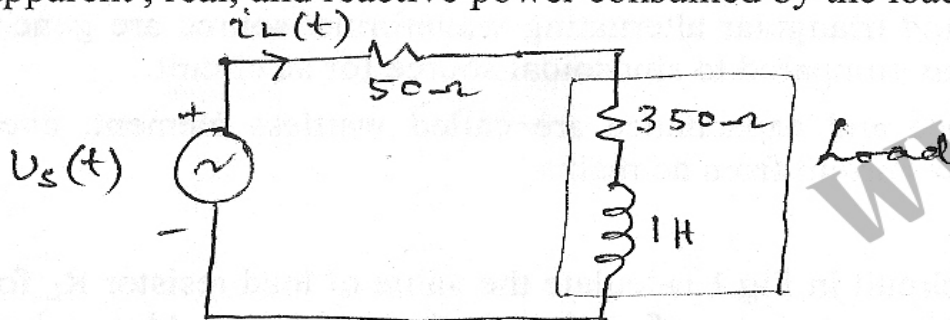


FIG. 4

4[a] A coil of resistance R and inductance L is shunted by a capacitor C . Show that, for parallel resonance, the effective resistance is $\frac{L}{CR}$.

Show also that the circulating current is $V\sqrt{\frac{C}{L}}$, so long as the resistance is small.

3

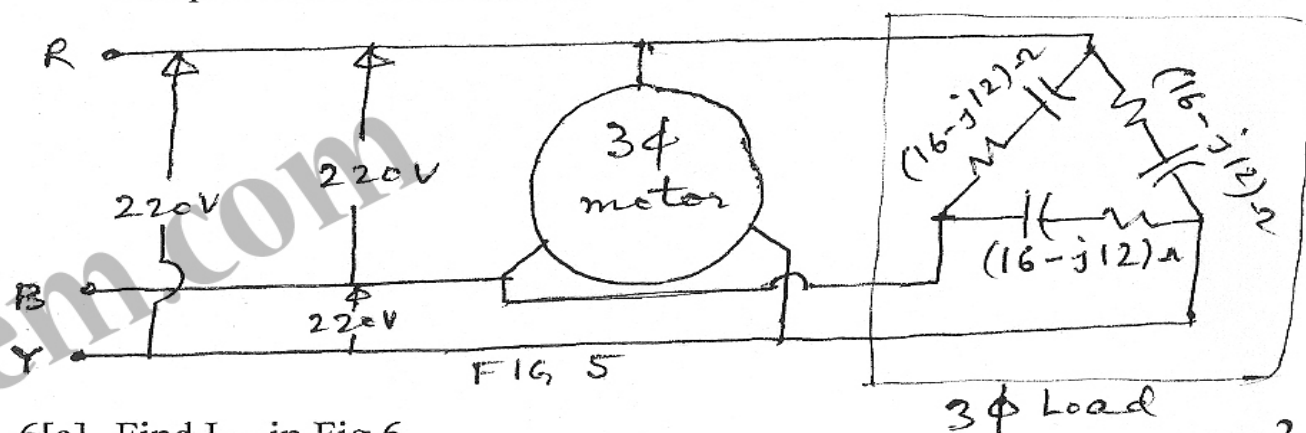
[b] A series circuit has a resistance of 2Ω and inductance of $0.25H$, a variable capacitance, and is connected across a 230 V , 50 Hz supply. Calculate

- The value of capacitance at resonance
- Q factor of the circuit and Bandwidth.

2

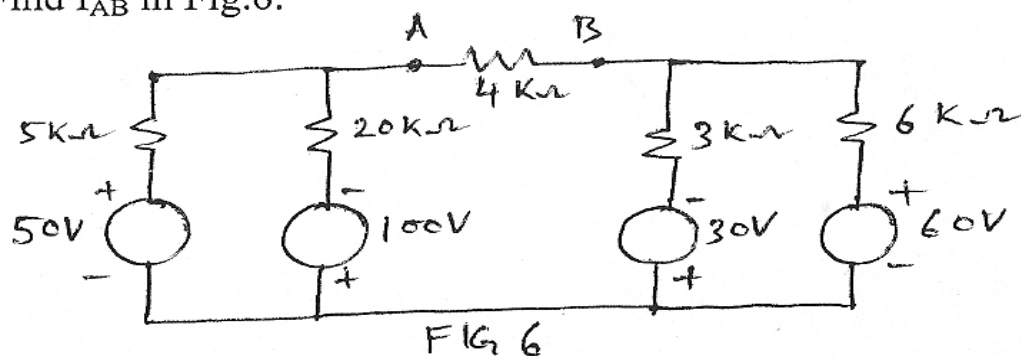
5 A 3 phase Y connected motor takes 10 KVA at 0.6 pf lag from a source of 220 V . It is in parallel with a balanced delta connected load as shown in Fig.5. Find the total volt amperes, active power, line current and p.f. of the combination.

5



6[a] Find I_{AB} in Fig.6.

2



[b] A circuit having VI characteristics as shown in Fig.7 has to be modelled as Thevenin's and Norton's form. Draw the equivalent circuits with computed values.

3

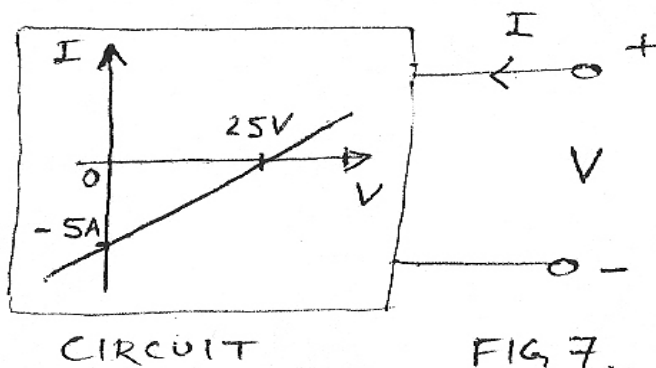


FIG 7.

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SECOND SEMESTER

B.E. (EC/EE/COE)

MID SEM EXAMINATION

March 2007

EC/EE/COE-112 APPLIED MECHANICS

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.

Local choices in questions 1 and 3 are to be made use of.

Assume suitable missing data, if any.

1[a] Explain Varignon's theorem.

1

[b] Determine the resultant of four forces, acting at A, B, C and D, tangential to the circle of radius 4 cm, as shown in Figure 1. Find the magnitude and location of the resultant w.r.t. the center of the circle, O.

5

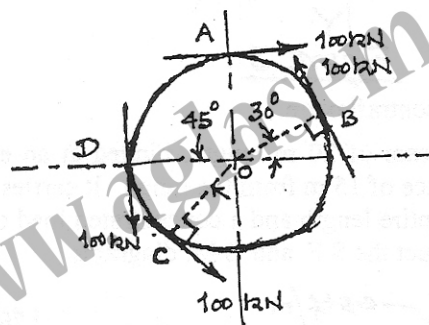


Figure 1.

[OR]

1[a] What is a 'just rigid truss'?

1

[b] Figure 2 shows a truss. Determine analytically forces in all its members. Also obtain reactions at both supports.

5

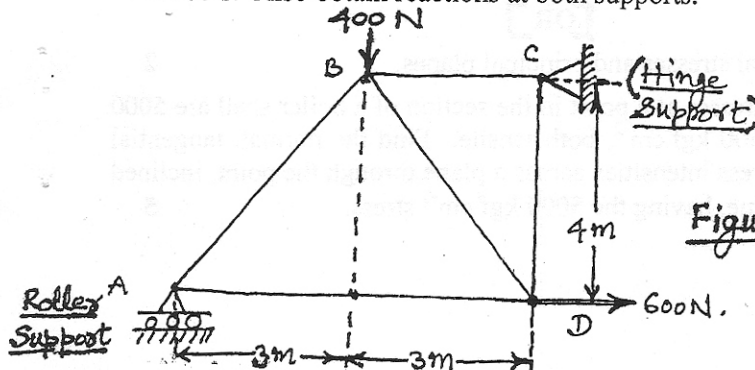


Figure 2.

- 2[a] What is understood by angle of repose and cone of friction? 2
- [b] Obtain the second moments of area and the section modulus of the section, shown in Figure 3 about the horizontal axis XX and vertical axis YY, passing through the centroid of the section. 5

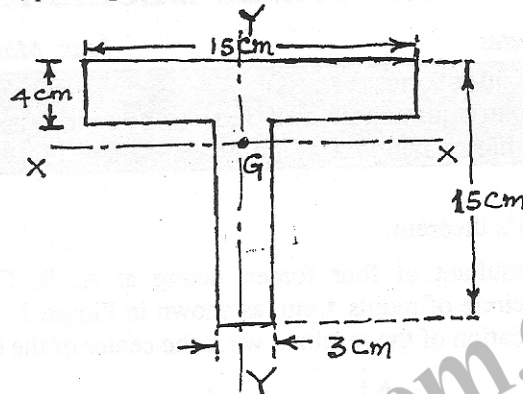


Figure 3.

- 3[a] Define the point of contraflexure. 1
- [b] Figure 4 shows a beam of 20 m length, hinged at an end and freely supported at a distance of 15 m from the hinge. It carries a u.d.l. of $0.5 \text{ tonnef.m}^{-1}$ over its entire length and a concentrated load of 16 tonnef at the free end. Construct the S.F. and B.M. diagrams. 6

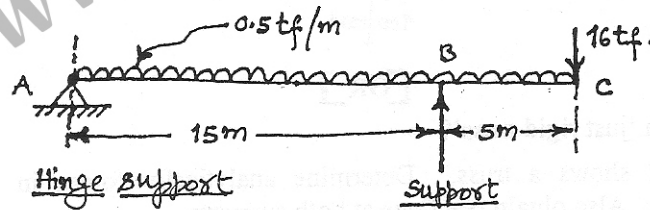


Figure 4.

[OR]

- 3[a] Explain principal stresses and principal planes. 2
- [b] The principal stresses at a point in the section of a boiler shell are 5000 kgf.cm^{-2} and 2500 kgf.cm^{-2} , both tensile. Find the normal, tangential and resultant stress intensities across a plane through the point, inclined at 50° to the plane, having the 5000 kgf.cm^{-2} stress. 5

SECOND SEMESTER

B.E. (COE/EC/EE)

MID SEM EXAMINATION

March

2007

COE/EC/EE-113 MATHEMATICS-II

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.

Assume suitable missing data, if any.

1[a] If $u = \tan^{-1}(y^2/x)$, Evaluate

$$x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy}$$

[b] Derive the formula for the second differential coefficient of an implicit function.

[c] Find the volume of the greatest rectangular parallelopiped that can be inscribed in the ellipsoid

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

7

2[a] Find the volume of the torus generated by revolving the circle $x^2 + y^2 = 4$ about the line $x = 3$.

[b] Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_{\sqrt{x^2+y^2}}^1 \frac{dz dy dx}{\sqrt{x^2+y^2+z^2}}$

[c] Find the area of the portion of the sphere $x^2 + y^2 + z^2 = 9$ lying inside the cylinder $x^2 + y^2 = 3y$

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SECOND SEMESTER

B.E. (EC/EE)

MID SEM EXAMINATION

March **2007**

EC/EE-114 PHYSICS-II

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.

Assume suitable missing data, if any.

- 1[a] The electric potential due to certain charge distribution is given by

$$\phi(x, y, z) = -\frac{V_0}{a^4} (x^2 yz + xy^2 z + xyz^2) V$$

Where V_0 and 'a' are constants. Calculate electric field intensity and charge density at points A (0,0,a) and B (a,a,a). **2**

- [b] A charge of $4 \times 10^{-8} \text{C}$ is distributed uniformly over the surface of a sphere of radius 0.01 m. It is covered by a concentric hollow conducting sphere of radius 0.05 meter. Find (i) the electric field intensity at a point 0.02 meter away from the center (ii) A charge of $6 \times 10^{-8} \text{C}$ is placed on the hollow sphere find the surface charge density on the outer surface of the hollow sphere. **3**

- 2[a] The electric repulsion between electrons is maximum when they are separated by 5 fm apart. Find the temperature at which the deuterons in plasma have average energy sufficient to surmount this potential barrier. **2**

- [b] Calculate the rate of consumption of hydrogen (in kg/second) in case of sun assuming that all the radiated energy is generated by the proton-proton cycle. Energy available per proton-proton cycle is 26.2 Mev and the power of the sun is $3.9 \times 10^{26} \text{W}$. **2**

- [c] What are the limitations on the fuel that can be used in a reactor whose moderator is ordinary water. Why is the situation different if the moderator is heavy water? **1**

- 3[a] For the d-t fusion ${}^3_1\text{H}(d,n){}^4_2\text{He}$, calculate (i) the Q value of reaction (ii) the rate at which deuterium and tritium are consumed to produce 1MW. **3**

- [b] Write down the Planck's radiation formula. Estimate the surface temperature of a star if the radiation it emits has a maximum wavelength of 446 nm. What is the intensity radiated by the star? 2

- 4[a] A long cylindrical conductor of radius 'a' carries a current along its length. The current density at a distance 'r' from the axis of the

conductor is given by $J(r) = J_0 \cdot \frac{r}{a}$, where J_0 is a constant.

Calculate the magnetic induction B as a function of r for $r \leq a$ and also for $r > a$. 2½

- [b] A parallel plate capacitor with a dielectric between its plates ($K = 2.5$) has a capacitance of 4 pF. This capacitor is connected to a battery of 20V. The slab of dielectric is then pulled out from the capacitor while the capacitor is still connected to the battery. Calculate the work done in this process assuming zero fictional losses. 2½

OR

- [a] A system has 5 particles arranged in two compartments. The first compartment has 6 cells and the second has 8 cells. The cells are of equal size. Calculate the number of microstates in macro state (2,3) if the particles obey Fermi Dirac statistics. 2½

- [b] Calculate the mean free path of the nitrogen molecules at 27°C temperature and one atmospheric pressure equal to 10^5 Nm^{-2} . The molecular diameter of nitrogen is 3.5×10^{-10} meter.

You may use following constants

Boltzmen constant $K_B = 1.38 \times 10^{-23} \text{ J/K}$

Wein's constant $b = 2.9 \times 10^{-3} \text{ mK}$

Stefan Boltzmen constant $\sigma = 5.67 \times 10^{-8} \text{ Wm}^{-2}\text{K}^{-4}$

Atomic mass

$$n = 1.008665 \text{ u}$$

$$^1\text{H} = 1.007825 \text{ u}$$

$$^2\text{H} = 2.014102 \text{ u}$$

$$^3\text{H} = 3.016050 \text{ u}$$

$$^4\text{He} = 4.002603 \text{ u}$$

2½

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SECOND SEMESTER

B.E. (EE/EC)

MID SEM EXAMINATION

March 2007

**EE/EC-115 ELECTRICAL ENGINEERING
MATERIALS**

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** from Part-A & any **TWO** questions from Part-B.
Use separate answer sheets for Part-A and Part-B.
Assume suitable missing data, if any.

Part-A

- 1[a] Define (i) lattice and basis; (ii) unit cell and (iii) Miller indices. 1.5
- [b] A lattice plane cuts intercepts $3a$, $-2b$ and $3c/2$ along the three axes. Deduce the Miller indices of the plane. 1
- [c] Name different types of bonding in solids. Mention the cause of bonding and important physical properties in each case. 1
- 2[a] Define (i) Critical magnetic field (ii) critical current and (iii) penetration depth for a superconductor. 1.5
- [b] What is the 'sure signature' of superconductivity? Why? 1
- [c] What is SQUID? How it is useful? 1
- 3[a] Differentiate between ferromagnetism, antiferromagnetism and ferrimagnetism. Give one example for each. 1.5
- [b] Discuss applications of ferromagnetic materials and ferrites. Why ferrites are used at high frequencies. 1.5

Part-B

- 1[a] Distinguish between lime soda and zeolite process. 2
- [b] Give the chemical reactions involved in determination of hardness of water by EDTA method. 2
- [c] Define priming and foaming in boilers. 1

2[a] What are the important characteristics of good refractories? On the basis of chemical properties how refractories are classified. 3

[b] Write the steps involved in manufacture of refractories. 2

3 Write a short note on any TWO of the following;

i. Ion Exchange process

ii. Dielectric materials

iii. Silica bricks

iv. Phosphate conditioning

v. Boiler corrosion.

5