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## SECOND SEMESTER

B.E. (COE/EC/EE)

MID SEMESTER EXAMINATION **MARCH** 2005

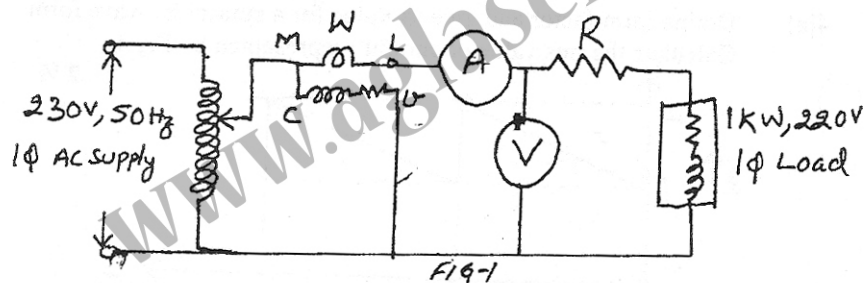
### COE/EC/EE-111 PRINCIPLES OF ELECTRICAL ENGINEERING

Time: 1 Hour 30 Minutes

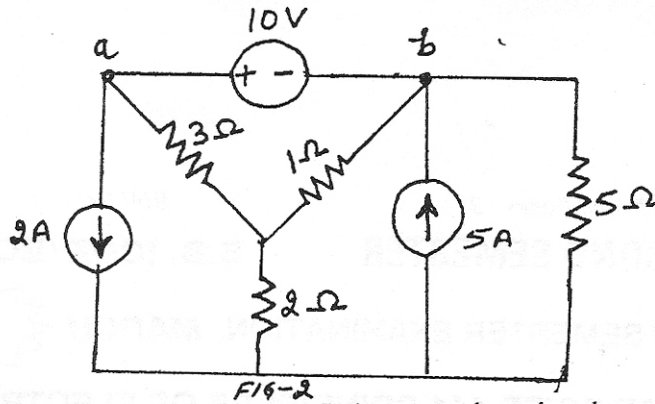
Max. Marks : 20

Note : Attempt ALL questions.  
Assume suitable missing data, if any.

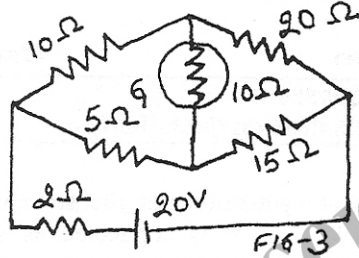
- 1[a] Define the rating of a potentiometer, rheostat and variac.  
A load of 1 kW, 220 V is connected as shown in Fig 1.  
design/select the rheostat, variac, ammeter, voltmeter and  
wattmeter to measure the power and power factor of the load.  
Also draw the phasor diagram of the circuit. 3



- [b] It is desired to construct an electronic thermometer using negative temperature co-efficient electronic device. Suggest a suitable alternative to mercury thermometer for measuring the temperature. 2
- 2[a] State and prove maximum power transfer theorem. 2
- [b] Find the power delivered by the 5A current source in the circuit shown in Fig.2 by using the nodal analysis. 3

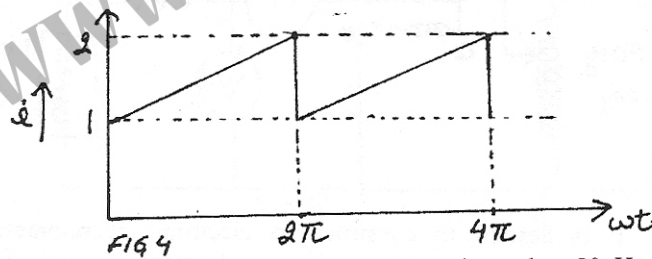


- 3[a] Using Thevenin's theorem find current through galvanometer connected in the circuit shown in Fig. 3. 3

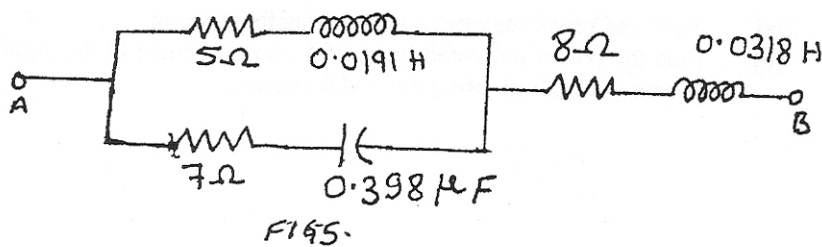


- [b] A 100 ohm resistor, 20  $\mu$ F capacitor and a 2H inductor are connected in series. At what frequency is the phase angle is 45°? 2

- 4[a] Define form factor and give its value for a sinusoidal wave form. Calculate the rms value of current  $i$  represented by Fig.4 2 1/2



- [b] In the circuit shown in Fig.5, determine what 50 Hz voltage must be applied across AB in order to that a current of 10A may flow in the capacitor. 2 1/2



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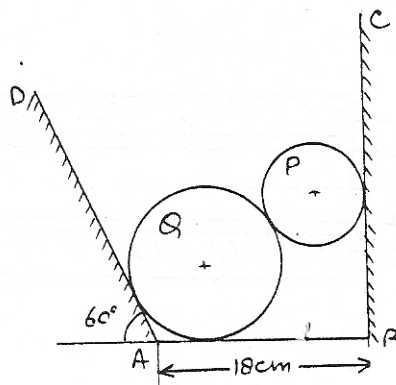
### COE/EC/EE-112 APPLIED MECHANICS

Time: 1 Hour 30 Minutes

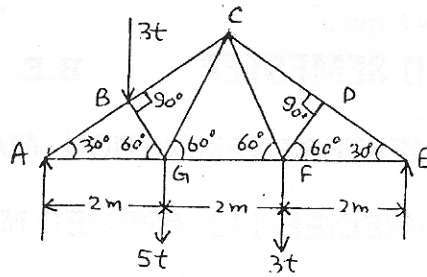
Max. Marks : 20

**Note :** Attempt **ALL** questions.  
Assume suitable missing data, if any.

- 1[a] If at a point in a two dimensional system, the normal stress on two mutually perpendicular planes are  $p$  and  $p'$  (both alike) and the shear stress is  $q$ . Show that one of the Principal stresses is zero if  $q^2 = pp'$  2
- [b] Establish relationship between Modulus of elasticity, Modulus of rigidity and Bulk Modulus (with poisson's ratio) 3
- [c] Two cylinders P and Q rest in a box as shown below. The cylinder P has diameter of 10 cm and weighs 20 kg while the cylinder Q has diameter 18 cm and weighs 50 kg. The channel is 18 cm wide at the bottom with one side vertical and the other inclined at  $60^\circ$  as shown. Find the pressures at all four points of contact. 3



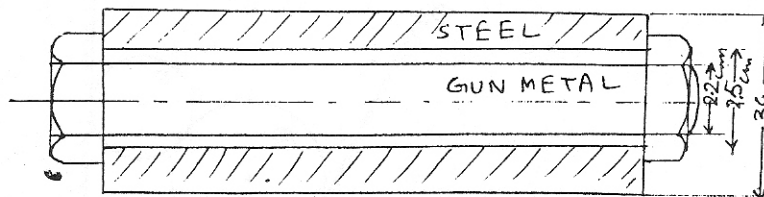
2[a] An inclined truss as shown below is loaded as shown. 4



Determine the nature and magnitude of the forces in all the members of the truss.

3. The mean diameter of a square threaded screw jack is 5 cm. The pitch of the thread is 1 cm. The coefficient of friction is 0.15. What force must be applied at the end of a 70 cm long lever which is perpendicular to the longitudinal axis of the screw (i) to raise a load of 2 tones, and (ii) to lower it. 4

4. A gunmetal rod screwed at the ends passes through a steel tube. The assembly heated to 300°F and the nuts on the rod are screwed tightly home on the ends of the tube. Diameter of the rod is 2.2 cm. The internal and external diameter of steel are 2.5 and 3 cm respectively. Find the intensity of stress in the rod and the tube when the common temperature has fallen to 60°F  
 coefficient of linear expansion of steel =  $6 \times 10^{-6}$  per °F  
 coefficient of linear expansion of copper =  $10 \times 10^{-6}$  per °F  
 $E_{\text{steel}} = 2.05 \times 10^6 \text{ kg/cm}^2$        $E_{\text{gunmetal}} = .915 \times 10^6 \text{ kg/cm}^2$



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## SECOND SEMESTER

B.E. (COE/EC/EE)

MID SEMESTER EXAMINATION **MARCH**

**2005**

### COE/EC/EE-113 MATHEMATICS-II

Time: 1 Hour 30 Minutes

Max. Marks : 20

**Note :** Attempt **ALL** questions. Selecting **TWO** parts from each questions.

Assume suitable missing data, if any.

1[a] Find  $\frac{du}{dx}$  if  $u = \sin(x^2 + y^2)$ , where  $a^2x^2 + b^2y^2 = c^2$ . 6

[b] At a distance of 50 meter  $N_s$  from the foot of a tower the elevation of its top is  $30^\circ$ . If the possible errors in measuring the distance and elevation are 2 cm and 0.05 degree respectively find the approximate error in the calculated height.

[c] Find stationery values of  $x^2 + y^2 + z^2$  subject to  $ax^2 + by^2 + cz^2 = 1$  and  $lx + my + nz = 0$

2[a] Solve  $x Dy + y = xy^3$  7

[b] Solve  $D^4y + 2a^2 D^2y + a^4y = \sin ax$

[c] Solve  $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} - \frac{dy}{dx} + y = 7 - 6x - 3x^2 + e^x$

3[a] Change the order of integration and hence evaluate the integral

$$\int_0^1 \int_x^{2-x} \frac{x}{y} dy dx \quad 7$$

- [b] Find the total area bounded by the lemniscates

$$r^2 = a^2 \cos 2\theta$$

- [c] Find the volume of the region in space bounded above by the surface  $z = 1 - (x^2 + y^2)$  on the sides by the planes  $x = 0$ ,  $y = 0$ ,  $x + y = 1$ , and below by the plane  $z = 0$ .

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## SECOND SEMESTER

B.E. (EC/EE)

MID SEMESTER EXAMINATION MARCH 2005

### 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] Can  $|x|$  be a wave function in the region  $-a$  to  $+a$ ,  $a > 0$ ? Justify. (1)
- [b] Determine the phase velocity of the wave corresponding to a de Broglie wavelength of  $\lambda = \frac{h}{mv}$  where  $m$  and  $v$  are mass and velocity of a particle respectively. Can the phase velocity exceed the velocity of light? (2)
- [c] A particle is confined in a one dimensional infinite potential well of width  $0.2$  nm. It is found that when the energy of the particle is  $230$  eV, its eigen function has  $5$  antinodes. Find the mass of the particle and test whether particle can have an energy equal to  $2$  KeV? (2)
- 2[a] Show that the ground state wavelength associated with electron in finite potential well is longer than the wavelength in corresponding state in infinite potential well. (3)
- [b] An  $\alpha$ -particle having energy  $5$  MeV strikes a potential barrier of height equal to  $30$  MeV. Determine the width of the potential barrier for maximum transmission coefficient. (Mass of  $\alpha$ -particle  $= 4 \times 1.6 \times 10^{-27}$  kg and  $h = 1.054 \times 10^{-34}$  Js). (2)
- 3[a] What are hadrons? Write the Quark structures of nucleons. (1)
- [b] Using uncertainty principle show that electron is not a constituent of nucleus. (1)
- [c] Use the semi empirical binding energy formula to calculate the binding energy of  ${}^{40}_{20}\text{Ca}$ . What is the percentage discrepancy

between this figure and the actual binding energy?  
 $(a_v=14.1\text{MeV}; a_s=13.0\text{ MeV}, a_c= 0.595\text{ MeV}, a_a = 19.0\text{ MeV}, a_p = 33.5\text{ MeV})$  (2)

- [d] For the d-t fusion reaction  ${}_1^3\text{H}(\text{d}, \text{n}) {}_2^4\text{He}$ , calculate (i) the Q-value of the reaction (ii) the rate at which deuterium and tritium are consumed to produce 1 MW. (Assume all energy from the fusion reaction is available.) (2)

OR

- 3[a] Show that current grows exponentially through an RC circuit, hence define the time constant or relaxation time of the circuit. (2½)

- [b] When the current in an RL circuit is decaying, what fraction of the original energy stored in the inductor has been dissipated after 2.3 time constants. (1½)

- [c] State Ampere's circuital theorem and obtain its differential form. Mention its significance. (2)

4 The effective Q for the proton-proton cycle is 26.2 MeV

- [a] Express this as energy per kilogram of hydrogen consumed.

- [b] The power of the sun is  $3.9 \times 10^{26}\text{ W}$ . If its energy derives from the proton-proton cycle, at what rate is it losing hydrogen?

- [c] At what rate is it losing mass? Account for the difference in the results for (a) and (b).

- [d] The sun's mass is  $2.0 \times 10^{30}\text{ kg}$ . If it loses mass at the constant rate calculated in (c), how long will it take to lose 0.10% of its mass? (4)

OR

- 4[a] What is polarization? Discuss electronic polarization and show that it is directly proportional to the applied electric field. (2½)

- [b] The polarization of neon gas is  $0.35 \times 10^{-40}\text{ Fm}^2$ . If the gas contains  $2.7 \times 10^{25}\text{ atoms/m}^3$  at  $0^\circ\text{C}$  and one atmosphere pressure, calculate its dielectric constant. (1½)

Atomic masses :

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

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

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

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

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

$${}^{40}\text{Ca} = 39.962591\text{ u}$$



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## SECOND SEMESTER

B.E. (EC/EE)

MID SEMESTER EXAMINATION **MARCH**

2005

### EC/EE-115 ELECTRICAL ENGINEERING MATERIALS

Time: 1 Hour 30 Minutes

Max. Marks : 20

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

#### PART-A

1. With a neat diagram show that there cannot be any end centered cubic crystal. 1
2. The atomic radius of aluminium is 143 picometers, calculate the volume of the unit cell in SI units. Aluminium crystallizes in face centered cubic structure. 1
3. Draw the crystal planes having Miller indices (102), (111) and (302) in a cubic crystal. 2
4. Monochromatic X-ray of wave length  $1.5 \text{ \AA}$  are incident on a crystal face having an interplaner spacing  $1.61 \text{ \AA}$ . Find the various orders in which Bragg's reflection can take place. 1
5. Write the expression for geometrical structure factor, clearly defining all the terms involved. Show which of the following planes will not give a spot on the X-ray plate (211), (012), (315) and (220). 2

6. The number of electrons per unit energy interval is given by the relation  $N(E) = D(E) f(E)$ , where the symbols have their usual meaning. Draw the variation of  $N(E)$  with energy at  $T = 0$  and  $T > 0$ . 1
7. At room temperature ( $25^{\circ}\text{C}$ ) electrical conductivity of intrinsic germanium is  $2.2 (\Omega\text{-m})^{-1}$ , estimate its conductivity at  $150^{\circ}\text{C}$ . Given energy gap of germanium is 0.67 eV, and Boltzmann constant is  $1.38 \times 10^{-23} \text{ JK}^{-1}$ . 2

### **PART-B**

- 1[a] What are the causes of hardness of water? Explain the soap titration method for the determination of hardness. 3+2
- [b] Give the composition, characteristics and applications of fireclay refractory. 3+2
2. Explain the chemical requirements for a good electroplating bath. 5
- 3[a] Discuss the role of the following plating variables on the nature of electrodeposit?
- (i) Throwing power
  - (ii)  $p^H$
- [b] Differentiate between PCE and RUL. 3+2
- 4[a] 10 A current is passed in alkaline copper bath for a period of one hour. The efficiency of deposition is 70%. Find out the thickness of deposit on an electrode of area  $12 \text{ cm}^2$  (At. Wt of Cu = 63.5).
- [b] Explain the term "Thermal Spalling" with reference to refractory. 3+2