

QP Code : 1033

(3 Hours)

Total Marks:100

NB: 1) Question Number 1 is compulsory.

2) Attempt any four questions out of remaining six questions.

- Q1 a) What is object oriented programming? Explain the features of object oriented programming. 5
b) Explain call-by value and call by reference with example. 5
c) What is virtual function? Explain the need of virtual function. 5
d) Differentiate class and structure with example. 5
- Q2 a) Write a program that can enter and display the data up to 10 employees using structure. Employee structure has members employee_code and salary. 10
b) What is default constructor? Explain with example. 10
- Q3 a) Write a program to find area and perimeter of the rectangle using pure virtual function. 10
b) Write a program to swap two numbers using pointers. 10
- Q4 a) Explain storage class with one programming example. 10
b) What are the different types of inheritance? Explain each with example. 10
- Q5 a) Write a program to display following pattern using nested loops :- 10
A
A B A
A B C B A
A B C D C B A
b) Write a program to check the entered number is prime or not. 5
c) Write a program to find factorial value of given integer number using recursion. 5
- Q6 a) What are inline functions? Discuss its advantages and disadvantages. Write program to demonstrate inline function. 10
b) Write a program in C++ to transpose a matrix. 10
- Q7. Write short note on any four 20
(a) this pointer
(b) Constructor & Destructor
(c) Bitwise operators
(d) Distinguish between Function Overloading and Operator Overloading
(e) break & continue

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APP PHY I

22/12/20

QP Code : 1030

(OLD COURSE)

(2 Hours)

[Total Marks : 75

- N.B. : (1) Question No.1 is compulsory.
(2) Attempt any four questions from Question Nos. 2 to 7.
(3) Use suitable data wherever required.
(4) Figures to the right indicate full marks.
(5) Illustrate your answer with sketches wherever necessary.

1. (a) Define space lattice, unit cell, lattice parameter, atomic basis ? 15
(b) What are liquid crystals ? State different phases.
(c) What is Fermi level ? Write Fermi-Dirac distribution function.
(d) The mobility of hole is $0.025 \text{ m}^2/\text{v-sec}$. What would be resistivity of p-type silicon if the Hall Coefficient of the sample is $2.25 \times 10^{-5} \text{ m}^3/\text{v-sec}$.
(e) What is Meissner effect in superconductors ?
(f) What is reverberation and reverberation time ?
(g) State with neat diagram: Direct and inverse piezoelectric effect.
2. (a) Explain Diamond crystal structure with proper diagram. Calculate the number of atoms per unit cell, atomic radius and atomic packing factor for Diamond unit cell. 8
(b) What is Hall effect ? Obtain an expression for Hall voltage and mobility of electrons in metals. Give two applications based on Hall effect. 7
3. (a) Define Critical temperature and critical magnetic field for superconductors. Also, discuss type-I and type-II superconductors. 8
(b) Explain the construction and working of C.R.O. 7
4. (a) Silicon has same crystal structure as diamond. Its density is $2.33 \times 10^3 \text{ kg/m}^3$ and atomic weight is 28.0. Calculate the lattice constant and atomic radius of it. 5
(b) Show that Fermi level in intrinsic semiconductor lies at the centre of the forbidden band. $E_F = E_C + E_g/2$ or $E_F = E_g/2$. 5
(c) Explain in brief the conditions necessary for good acoustical design of an auditorium. 5
5. (a) Calculate the smallest glancing angle at which X-ray of 1.549 \AA will be reflected from crystal having spacing of 4.255 \AA . What is highest order reflection that can be observed. 5
(b) Explain the formation of barrier potential in P-N junction. 5
(c) Find the natural frequency of vibration of a quartz plate of thickness 2 mm. 5
Given that Young's modulus for quartz = $8 \times 10^{10} \text{ N/m}^2$ and the density = 2650 kg/m^3 .
Also calculate the change in thickness required if the same plate is to be used to produce ultrasonic waves of frequency 3MHz.

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6. (a) Derive the Braggs law for the diffraction of X- rays in crystals. Give its importance. 5
(b) Show that superconductors are perfect diamagnetic materials. 5
(c) An ultrasonic beam of wavelength sent by a ship returns from sea bed after 2 sec. If the velocity of ultrasonic beam in sea water is 1510 m/s at 0°C, its salinity at 30°C is 29 gm/lit, calculate the depth of sea bed at 30°C and frequency of ultrasonic beam. 5
7. (a) What is defect ? Explain various point defects in crystals. 5
(b) A hall of volume 5500 m³ is found to have a reverberation time of 2.3 sec. The sound absorbing surface of hall has an area of 750 m². Calculate the average absorption coefficient. 5
(c) Explain how the C.R.O. can be used to determine (i) dc voltage (ii) ac voltage (iii) time period/frequency. 5

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SARDAR PATEL INSTITUTE OF TECHNOLOGY, ANDHERI

Applied Chemistry-I

QP Code : 1021

(2 Hours)

[Total Marks : 75

- N.B. :** (1) Question No. 1 is compulsory.
 (2) Attempt any four questions from remaining six questions.
 (3) Figures to the right indicates full marks.
 (4) Atomic weights - Al = 27, Ca = 40, S = 32, Cl = 35.5, Fe = 58.8,
 K = 39, H = 1, C = 12, N = 14, O = 16, Na = 23, Mg = 24

1. Solve any five 15
- Write the salient features of condensation polymerisation.
 - Differentiate between temporary and permanent hardness.
 - 6 ml of an oil taken out from a gear box required 3.5 ml of 0.05N KOH for titration. Find acid value (Density = 0.75 gm/ml)
 - What are the advantages of solar energy?
 - Define phase, component and Degree of freedom.
 - What are the functions of lubricants?
 - State the structural details of graphite.
2. (a) Calculate the amount of lime (95% pure) and soda (80% pure) required for softening of 20,000 liters of boiler feed water containing following impurities. 6
- $\text{Ca}(\text{HCO}_3)_2 = 15.5 \text{ ppm}$
 - $\text{CaSO}_4 = 6.5 \text{ ppm}$
 - $\text{CaCl}_2 = 12.5 \text{ ppm}$
 - $\text{MgSO}_4 = 10.00 \text{ ppm}$
 - $\text{Mg}(\text{HCO}_3)_2 = 15 \text{ ppm}$
 - $\text{SiO}_2 = 8.9 \text{ ppm}$
- (b) What is fabrication of plastics? Explain in detail compression moulding method of fabrication of plastics. 5
- (c) Write a note on photovoltaic Cell. 4

[TURN OVER

3. (a) Write short notes on - 6
i) Compounding of plastics
ii) Glass transition temperature
(b) What is lubrication? Explain Fluid film lubrication mechanism. 5
(c) What are applications of nanomaterials in the field of Environmental 4
technology and Medicines.
4. (a) Write definition and significance of following properties of lubricants. 6
i) Cloud point and pour point
ii) Viscosity and viscosity Index
(b) Explain application of Gibb's phase rule to water system. 5
(c) 1500 litres of hard water was softened by zeolite softener. After it got exhausted, 4
required 50 litres of NaCl containing 110gm per lit. of NaCl for its
regeneration. Calculate the hardness of water.
5. (a) What is plain carbon steel? What are the drawbacks of plain carbon steel? 6
Explain the classification of plain carbon steel on the basis of carbon content.
(b) Explain the demineralization of hard water with neat diagram and appropriate 5
reactions.
(c) Define Plastics. Write preparation properties and uses of PMMA. 4
6. (a) Describe Laser method for production of carbon nanotubes. Write 6
applications of carbon nanotubes.
(b) Explain reactions of lime and soda used for softening of hard water. 5
(c) Explain how biogas is produced from biomass. 4
7. (a) What are drawbacks of natural rubber? Explain vulcanization process in detail 6
to improve the properties of rubber.
(b) Explain activated sludge process to control water pollution. 5
(c) What are applications and limitations of phase rule? 4

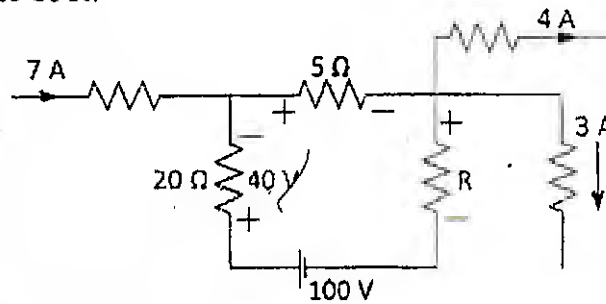
QP Code : **1017**

(3 Hours)

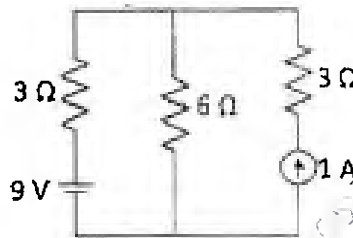
[Total Marks : 100

- M.B. :** (1) Question No. 1 is compulsory.
 (2) Attempt any four out of remaining.

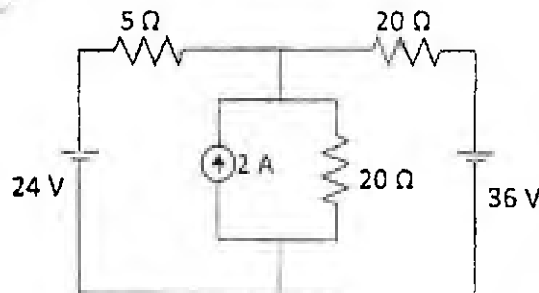
1. (a) Find value of R.



- (b) Find current through 2Ω superposition theorem.

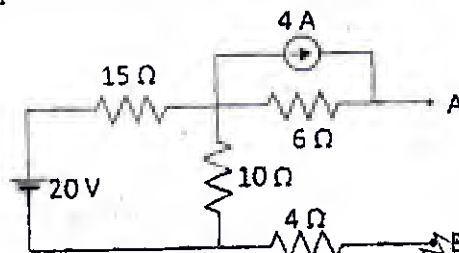


- (c) Define peak factor and form factor. 2
 (d) Draw variation of R, Z, and $\cos\phi$ with frequency in RLC series resonant circuit. 3
 (e) In a three phase delta connected circuit phase current $\bar{I}_{RY} = 10 \angle 20^\circ$ A. Find 2
 line current \bar{I}_R . Phase sequence is RYB.
 (f) Draw circuit diagram to carry out open circuit test on a single phase transformer. 3
 (g) Explain slip in a three phase induction motor. 2
 (h) Define ripple factor in case of rectifier. 2
2. (a) Find current in 5Ω by nodal analysis. 6

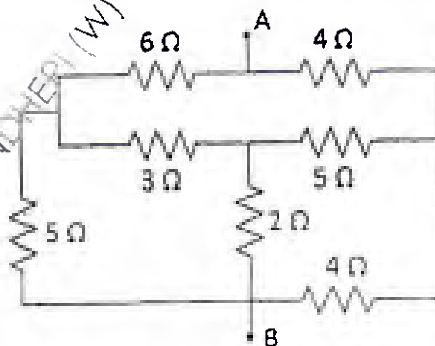


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- (b) A 100Ω resistance is connected in series with a choke coil. A voltage of 400 V , 50 Hz is applied across this combination. The voltages across resistance and coil are 200 V and 300 V respectively. Find resistance and reactance of a coil. 6
- (c) Draw the phasor diagram of transformer on leading power factor load. 8
3. (a) Derive the relation between line and phase quantities in three phase star connected load. 8
 (b) Draw an equivalent circuit of a single phase transformer. Name all the components of it. 4
 (c) Explain why single phase induction motor is not self starting. 8
4. (a) Find the Norton's equivalent circuit for the network shown across terminals A & B. 7



- (b) Three currents are meeting at a point. Find the resultant current. 4
 $i_1 = 15 \sin(\omega t) \text{ A}$, $i_2 = 20 \cos(\omega t - 20^\circ) \text{ A}$, $i_3 = 5 \sin(\omega t + 45^\circ) \text{ A}$.
- (c) In a three phase RYB system, line voltage is 173.2 V . Wattmeter in line R and Y read 301 W and 1327 W respectively. Find line current in the circuit. 4
- (d) Explain full wave rectifier with centre tap transformer. Draw suitable waveforms. 5
5. (a) Find equivalent resistance between A & B in the network shown. 7



- (b) A series circuit having resistance 20Ω & inductance of 0.07 H is connected in parallel with a series combination of resistance of 50Ω and a capacitor of $60 \mu\text{F}$. Calculate the total current when parallel combination is connected across 230 V , 50 Hz supply. 5

- (c) The OC & SC test on a 5 KVA, 200 V/400 V, 50 Hz, single phase transformer 8
gave following test results :

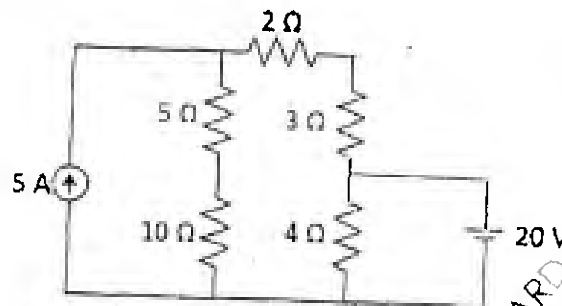
OC Test (meters on LV) 200V, 1A, 100W

SC Test (meters on HV) 15V, 10A, 85W.

Calculate equivalent circuit parameters referred to primary.

Calculate efficiency of transformer at full load, 0.8 pf Lag.

6. (a) Find current through 3Ω by superposition theorem.



- (b) A series resonant circuit has an impedance of 500Ω at the resonant frequency. 7
The upper and lower cut off frequencies are 10KHz and 100Hz respectively.
Find resonant frequency, values of R, L, C and quality factor.
- (c) Prove that the two wattmeter method can measure power input taken by a three 6
phase star connected circuit.
7. (a) A current flowing through a pure inductor is $i = 50 \sin(500t - 20^\circ)$ A. If voltage 2
applied to it is 200V. Write an instantaneous equation of a voltage across it.
- (b) A series circuit contains resistance of 10Ω & an inductive reactance of 20Ω . 3
Find admittance of the circuit and its components.
- (c) A 15 KVA transformer was loaded as follows :— 5
4 KVA at 0.5pf for 12 hours
15 KVA at 0.8 pf for 6 hours
18 KVA at 0.9 pf for 6 hours. If iron loss and full load copper loss both are equal
to 153 W, Find all day efficiency.
- (d) With the neat diagrams, explain types of DC motor. 5
- (e) Draw and explain input and output characteristics of CE configuration of BJT. 5

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Course: F.E. (R-2007) (ALL BRANCHES) (SEM - I) (PROG- T0111)

QP Code: 1017

Correction:

Original Question is

Que. No. 1(b). Find the Current through 2ohm by superposition theorem.

Corrected Question is

Que. No. 1(b). Find current through 6 ohm by superposition.

Query Update time: 14/12/2015 12:15 PM

- N.B. : (1) Question No.1 is compulsory.
(2) Answer any four out of remaining six questions.
(3) Assume any suitable data wherever necessary.

1. a) Express $\frac{(\sqrt{3}-1)^{10}}{(1+i)^{10}}$ in the form of P+i Q. 3
- b) Find y_n if $y = \sin^2\theta \cos^3\theta$ 3
- c) Prove that $\vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a}) + \vec{c} \times (\vec{a} \times \vec{b}) = 0$ 3
- d) Prove that $\tan^{-1}x = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots$ 3
- e) If $u = (1-2xy+y^2)^{-1/2}$ prove that 4

$$x \frac{\partial u}{\partial x} - y \frac{\partial u}{\partial y} = y^2 u^3$$
- f) Find the point upon the plane $ax + by + cz = P$ at which the function 4
 $f = x^2 + y^2 + z^2$ has a minimum value and find this minimum f .
2. a) Find all the roots of $x^{12} - 1 = 0$ and identify the roots which also are the roots 6
of $x^4 - x^2 + 1 = 0$
- b) if $x - \frac{1}{x} = 2i \sin \theta$; $y - \frac{1}{y} = 2i \sin \phi$ 6
& $z - \frac{1}{z} = 2i \sin \psi$, prove that $xyz + \frac{1}{xyz} = 2 \cos(\theta + \phi + \psi)$
- c) If $z = f(u)$ is homogeneous function in two variables x and y . Prove that 8

$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = n \frac{f(u)}{f'(u)}$$
- Hence verify the theorem for the function $u = \log \left(\frac{x^2 + y^2}{xy} \right)$
3. a) Find if LMVT is applicable to the function 6
 $f(x) = x + \frac{1}{x}$ on $[1, 3]$

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b) Verify the result

$$\frac{d}{dt}(\vec{a} \times \vec{b}) = \vec{a} \times \frac{d\vec{b}}{dt} + \frac{d\vec{a}}{dt} \times \vec{b}$$

$$\text{for } \vec{a} = 5t^2 \hat{i} + t \hat{j} - t^3 \hat{k}$$

$$\vec{b} = \sin t \hat{i} - \cos t \hat{j} - 0 \hat{k}$$

c) Prove that $e^{\cos^{-1}x} = e^{\pi/2} \left[1 - x + \frac{x^2}{2} - \frac{x^3}{3} + \dots \right]$

4. a) If $\sin h(\theta + i\phi) = \cos \alpha + i \sin \alpha$ prove that $\sin h^2 \theta = \cos^2 \alpha = \cos^2 \phi$

b) Test the convergence of $\sum_{n=1}^{\infty} \frac{3^n + 4^n}{4^n + 5^n}$

c) If $y = e^{a \sin^{-1} x}$ prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+a^2)y_n = 0$
find $y_n(0)$

5. a) If $y = x \log(x+1)$ prove that $y_n = \frac{(-1)^{n-2}(n-2)(x+n)}{(x+1)^n}$

b) Using L'Hospitals' rule evaluate $\lim_{x \rightarrow 0} \frac{1}{x} (1 - x \cot x)$

c) Find the directional derivative of $f = \frac{1}{(x^2 + y^2 + z^2)^{1/2}}$ at $P(1, 1, 1)$ in the direction of $\vec{a} = \hat{i} + \hat{j} + \hat{k}$

6. a) If $u = \sin^{-1}(x/y) + \tan^{-1}(y/x)$

Find the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$

e) A fluid motion is given by $\vec{v} = (y+z)\hat{i} + (z+x)\hat{j} + (x+y)\hat{k}$
show that the motion is irrotational

c) Prove that $\tan^{-1}(e^{i\theta}) = \frac{n\pi}{2} + \frac{\pi}{4}$

$$= \log \tan \left(\frac{\pi}{4} - \frac{\theta}{2} \right)$$

[TURN OVER

7. a) Show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube. 6
- b) Find $[(3.82)^2 + 2(2.1)^3]^{1/5}$ approximately by using the theory of approximation. 6
- c) (i) Separate $(\sqrt{i})^i$ into real and imaginary parts. 4
- (ii) Find the general value of $\text{Log}(1+i\sqrt{3}) + \text{Log}(1-i\sqrt{3})$ 4