F.E (Old) 21/06/17

T0111 / T1858 APPLIED CHEMISTRY I.

Q.P. Code : 528401

(2 Hours) **[Total Marks : 75]**

N.B. 1) Question No.1 is compulsory.
2) Solve any four questions from remaining questions.
3) Figures to right indicate full marks.
4) Figures to right indicate full marks.
(At-wts- Na= 23, 0=16, Si= 28, Cl= 35.5, Mg= 24, Ca= 40, H= 1, C= 2, S= 32,)

1. Solve any five: **15**

a) Give brief account of ultrafiltration.
b) Distinguish between thermoplastic and thermosetting plastic.
c) Write conditions under which situation solid lubricants used.
d) Write drawbacks of plain carbon steels.
e) What are fullerenes? State their uses.
f) Distinguish between conventional and non-conventional energy sources.
g) 1.5gm of oil was saponified with 50 ml of 0.1 N KOH solution. After refluxing the mixture required 7 ml of 0.1 N HCl for neutralization. Find saponification value of oil.

2. a) Calculate the amount of lime (95% pure) and soda (90% pure) required for softening of 30,000 litres of boiler feed water containing following impurities. **06**
$Ca(HCO_3)_2$ = 16.2 ppm $MgSO_4$ = 12.0 ppm $CaCl_2$ = 22.2 ppm
$Mg(HCO_3)_2$ = 16.8 ppm $CaSO_4$ = 13.6 ppm NaCl = 5.6 ppm

b) What are the main constituents of plastic? Write the functions and examples of each constituent. **05**

c) Write note on Rechargeable Nickel- Hydrogen batteries. **04**

3. a) What is meant by fabrication of plastic? Explain compression moulding with the help of a neat diagram. **06**

b) What is lubrication? Discuss the mechanism of thin film lubrication. **05**

c) Describe the laser method for production of Carbon Nanotubes. State the applications of Carbon Nanotubes. **04**

(TURN OVER)

4. a) Explain any two of the following properties of lubricants: 06
(i) Oiliness (ii) Flash and fire point

b) What is Gibbs phase rule? Explain application of phase rule to water system with the help of phase diagram. 05

c) The hardness of 30000 litres of water was completely removed using zeolite softener. The softener required 200 liters of NaCl solution containing 20 gms/liter of NaCl for regeneration. Calculate the hardness of water sample. 04

5. a) Define degree of freedom and explain the application of phase rule to two components Lead-Silver system. 06

b) Explain activated sludge process with the help of flow- sheet diagram. 05

c) Write a note on glass transition temperature of polymers.

6. a) Explain the application of nonmaterials in medicines and catalysis. 06

b) Define COD and BOD with its significance. 05

c) Write a note on hydrogen as a fuel. 04

7. a) Write the preparation and uses of (i) Polyurethane (ii) Buna-S Rubber. 06

b) Explain the principle of lime soda process with the help of all reactions. 05

c) Explain the specific effects of the following metals on the properties of steels. 04
(i) Tungsten (ii) Molybdenum

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F.E - Sem-I (OLD). Dt: 08/06/2017

(02)

Q.P.Code:09909

Time: 2 Hours **Total Marks:75**

N.B.(1) Question No. 1 is compulsory.

(2) Attempt any four questions from Q.No.2 to Q.No. 7.

(3) Use suitable data wherever required.

(4) Figures to the right indicate full marks.

(5)Illustrate your answer with sketches wherever necessary.

1. Attempt any five from the following:
   (a) Define the terms: Space lattice, Unit cell and lattice parameter. (3)
   (b) What are liquid crystals? Name the types of liquid crystals. (3)
   (c) What is Fermi level? Write Fermi Dirac distribution function. (3)
   (d) Find the resistivity of intrinsic germanium at 300K. Given the density of carriers as $2,5 \times 10^{19}/m^3$, $\mu_e = 0.39\ m^2/V\text{-sec}$ and $\mu h = 0.19\ m^2/V\text{-sec}$. (3)
   (e) What is Meissner effect in superconductors. (3)
   (f) State Sabine's formula . Explain the terms involved in it. (3)
   (g) State with neat diagram: Direct and inverse Piezoelectric effect. (3)
2. (a) Discuss diamond structure with neat diagram and also determine effective number of atoms per unit cell, co-ordination number, atomic radius and APF. (8)
   (b) What is Hall effect ? Obtain the expression for Hall Voltage for an extrinsic semiconductor. Give two applications based on hall effect. (7)

3. (a) Define critical temperature and critical magnetic field. Also discuss Type I and Type II superconductors? (8)

   (b) Explain construction and working of Cathode Ray Oscilloscope (7)

4. (a) Describe NaCl crystal structure with the help of diagram for 'r', CN, APF (5)

   (b) Show that Fermi level in intrinsic semiconductor lies at the middle of forbidden energy gap. (5)

   (c) A hall of length 20 m, breadth 15 m, and height 10 m has reverberation time 2 sec. Calculate the average coefficient of absorption. (5)

5. (a) Cesium crystallizes in a certain type of cubic structure with lattice constant 6.14 A^0. Identify the exact type of structure in which Cs crystallizes . Given: Atomic weight=132.91, density = $1900Kg/m^3$. Also evaluate the total number of cesium atoms/m^3 in the crystal. (5)

   (b) What is potential barrier? How it is formed in P-N junction. (5)

Turn Over

(c) Explain with neat labeled diagram the construction and working of piezoelectric oscillator . (5)

6. (a) Explain the construction and working of Braggs X-ray spectrometer to determine the crystal structure , (5)

(b) Show that superconductors are perfect diamagnetic materials. (5)

(c) Find the depth of sea water from the ship on sea surface if the time interval of 2 seconds is required to receive the signal back. Given that the temperature of sea water is 20°C and salinity is 10 gm/lit (5)

7,(a) What are real crystals? Differentiate between Frenkel and Schottky defect, (5)

(b) Explain in brief the conditions necessary for good acoustical design of an auditorium. (5)

(c) Explain how CRO is used to determine: (i) DC voltage (ii) AC voltage (iii) Time period/frequency. (5)

(2)

F.E. Sem I. Cold) 26/05/2017

Q.P. Code :17101

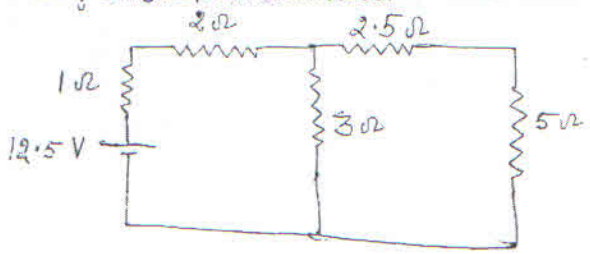
[Time: Three Hours] **[Marks:100]**

Please check whether you have got the right question paper.

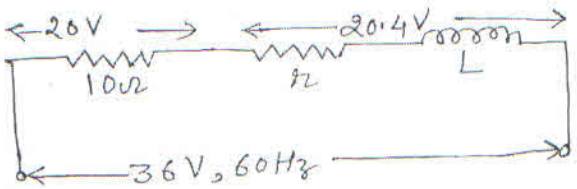
N.B:
1. Question.No.1 is compulsory.
2. Solve any four questions out of remaining six questions.
3. Assume any suitable data if necessary.

Q.1 a) Explain voltage division rule for series circuit. **03**
b) Give the statement of Thevnin's theorm. **02**
c) What is r. m. s and average values of A. C. quantities? **03**
d) What is the significant of resonance in series circuit? **03**
e) What is line and phase voltage? **02**
f) Draw the equivalent circuit of transformer with reference to primary side. **03**
g) Explain different configuration of transistor. **02**
h) What is the principle of operation of three phase induction motor? **02**

Q.2 a) Find the current in 1Ω resistor by using loop current method. **06**



Q.2 b) Find r and L in the circuit given **06**



Q.2 C) A 80 KVA, 3200/400V, single phase, 50Hz transformer has 111 turns on Secondary side. Calculate **08**
i) No.of turns in primary side
ii) Secondary full load current
iii) Cross-section area of the core if maximum flux density is 1.2 tesla

Q.3 a) Establish the relation betweeen line and phase current in Delta connected load. **08**
Q.3 b) Explain the working principle of single phase transformer. **04**
Q.3 c) Explain the constructional detail of single phase induction motor. **08**
Q.4 a) Find the current in 5Ω resistance using Thevnin's theorm. **07**

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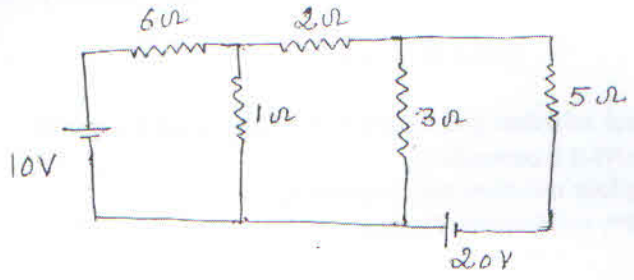
Q.P. Code :17101

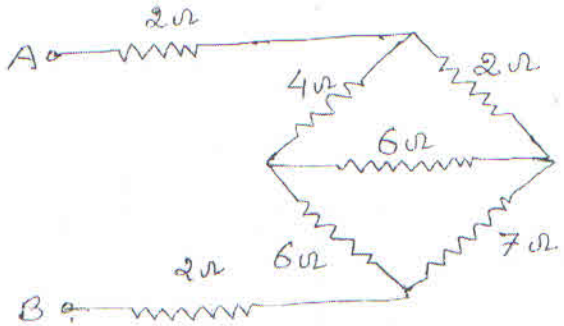


Q.4 b) Draw the phasor diagram for R-L series circuit. **04**

Q.4 c) Explain power measurement by two wattmeter method in three-phase circuit. **05**

Q.4 d) Draw and explain V-I characteristics of Dicode. **04**

Q.5 a) Find the equivalent resistance between the terminal A & B. **07**



Q.5 b) A coil of 0.6 pf is in series with a 100 μF capacitor and is connected with 50Hz supply. The potential difference across the coil is equal to the potential difference acrosss the capacitor. Find the inductance and resistance of the coil. **05**

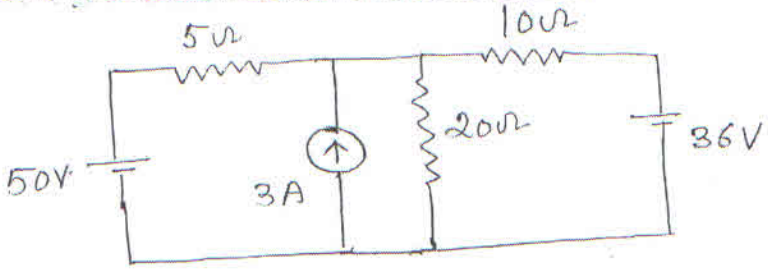
Q.5 c) Obtain equivalent circuit of 200/400V 50Hz single phase transformer from following test data. **08**

O.C.test 200V 0.7A 70W (l.V.Side)

S.C.test 15V 10A 85W (h.V.Side)

Calculate the Secondary voltage when delivering 5 KW at 0.8 PF lagging, the primary voltage is 200V.

Q.6 a) Determine the current in 5 resistor in the network shown by superposition theorm **07**



Q.6 b) A R-L-C series circuit has the following parameters R=10Ω, L=0.014 H, C=100 μF. **07**

Calculate the following

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Q.P. Code :17101

a) Reasonant frequency in rad/sec
b) Quality factor of the circuit
c) Band width of the circuit

Q.6 c) Three identical coils, each having resistance 15Ω and inductance 0.3 H are connected in Delta in 3-Phase 50Hz, 230V supply. Calculate the phase current line current and total power absorbed. **06**

Q.7 a) Explain why power dissipated in pure capacitor is zero. **02**
b) Explain active, reactive and apparent power in three phase circuit. **03**
c) Explain different types of losses in transformer. **05**
d) Explain the constructional detail of D.C.motor. **05**
e) Explain input and output characterisics of common emmitter configuration. **05**

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FE Sem-I (OLD)

Applied Maths-I

Q.P. Code : 13158

02

[Time : 3 Hours] **[Marks : 100**

Please check whether you have got the right question paper.

N.B:
1. Question **No. 1** is **compulsory**.
2. Attempt **any four** questions from **No.2** to **No.7**.
3. Answer to **sub-question** should be **written** together.

1. a) Find the complex number 'z' if $\arg(z+1)=\frac{\pi}{6}$ and $\arg(z-1)=\frac{2\pi}{3}$. 3

b) If $u=\log(\tan x+\tan y+\tan z)$, prove that $\sin 2x\frac{\partial u}{\partial x}+\sin 2y\frac{\partial u}{\partial y}+\sin 2z\frac{\partial u}{\partial z}=2$. 3

c) P.T. $\left[(\bar{a}\times\bar{b})\times(\bar{a}\times\bar{c})\right]\cdot\bar{d}=(\bar{a}\cdot\bar{d})\left[\bar{a}\,\bar{b}\,\bar{c}\right]$ 3

d) P.T. $\sin x=x-\frac{x^3}{3!}+\frac{x^5}{5!}-\frac{x^7}{7!}+....$ 3

e) Find the nth order derivative of $y=\sin 2x\sin 3x\cos 4x$. 4

f) Find the minimum distance of the origin from the plane $3x+2y+z-12=0$. 4

2. a) If α and β are the roots of the equation $x^2-2x+4=0$; then S.T. 6

$$\alpha^n+\beta^n=2^{n+1}\cos\left(\frac{n\pi}{3}\right)$$

Hence, Find the value of $\alpha^{15}+\beta^{15}$.

b) If $\operatorname{cosec}\left(\frac{\pi}{4}+ix\right)=u+iv$ prove that $\left(u^2+v^2\right)^2=2\left(u^2-v^2\right)$. 6

c) State and prove Euler's theorem for the function of two variables. 8

3. a) If $f(x),\varphi(x),\psi(x)$ are differentiable in [a, b], show that there exists a value c in (a, b) such that 6

$$\begin{vmatrix} f(a) & \varphi(a) & \psi(a) \\ f(b) & \varphi(b) & \psi(b) \\ f'(c) & \varphi'(c) & \psi'(c) \end{vmatrix}=0$$

b) Find the directional derivative of $\varphi=x^4+y^4+z^4$ at point A (1, -2, 1) in the direction of AB where B is (2, 6, -1). Also find the maximum directional derivative of φ at (1, -2, 1). 6

c) If ω is a complex cube root of unity prove that $(1-\omega)^6=-27$. 8

TURN OVER

4. a) If $\cos\alpha+\cos\beta+\cos\gamma=0$ and $\sin\alpha+\sin\beta+\sin\gamma=0$ Prove that 6

i) $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=\cos^2\alpha+\cos^2\beta+\cos^2\gamma=\frac{3}{2}$

ii) $\cos 2\alpha+\cos 2\beta+\cos 2\gamma=0$

b) Test for convergence $\sum\frac{2^n+1}{3^n+n}$. 6

c) If $y=2^x\sin^2 x\cos^3 x$ Find y_n. 8

5. a) If $y=\cos^{-1}x$ prove that, $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-n^2y_n=0$. 6

b) Evaluate $\lim_{x\to 0}\frac{\sinh x-x}{x^3}$. 6

c) Find the divergence $\overline{F}$ and curl $\overline{F}$ where $\overline{F}=\frac{1}{x^2+y^2}(xi-yj)$. 8

6. a) If $u=f\left(e^{y-z},e^{z-x},e^{x-y}\right)$ then prove that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$. 6

b) Use Rolle's theorem to prove that the equation $ax^2+bx=\frac{a}{3}+\frac{b}{2}$ has a root between 0 and 1. 6

c) Prove that $\sin^{-1}(\operatorname{cosec}\theta)=\frac{\pi}{2}+i\log\cot\frac{\theta}{2}$. 8

7. a) If $u=\frac{1}{\sqrt{x^2+y^2+z^2}}$ then find $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}$ 6

b) Find all stationary values of $x^3+3xy^2-15x^2-15y^2+72x$. 6

c) If $(a+ib)^p=m^{x+iy}$ then P.T. 8

$\frac{y}{x}=\frac{2\tan^{-1}\left(b/a\right)}{\log\left(a^2+b^2\right)}$.