

Total No. of Questions : 9  
(2057)



Total Pages : 5

**B.Tech. IInd Semester Examination**  
**APPLIED MATHEMATICS-II**  
Paper - AS-1006

Time : Three Hours]

[Maximum Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all, selecting one question each from Sections A, B, C and D, and all the subparts of the question in Section E. Use of Non-programmable calculators is allowed.

**SECTION-A**

1. (a) Find the directional derivative of  $\text{div} (x^5 \hat{i} + y^5 \hat{j} + z^5 \hat{k})$  at  $(2, 2, 1)$  in the direction of outward normal to the surface  $x^2 + y^2 + z^2 = 9$  at the point. 6
- (b) Evaluate  $\int_S \vec{F} \cdot \hat{n} dS$  where,  $\vec{F} = 2x^2 y \hat{i} - y^2 \hat{j} + 4xz^2 \hat{k}$  and  $S$  is the closed surface of the region in the first octant bounded by the cylinder  $y^2 + z^2 = 9$  and the planes  $x = 0$ ,  $x = 2$ ,  $y = 0$  and  $z = 0$ . 9

2. (a) Prove that  $\int_C (y dx + z dy + x dz) = -2\pi a^2 \sqrt{2}$ , where  $C$  is the curve  $x^2 + y^2 + z^2 - 2ax - 2ay = 0$ ,  $x + y = 2a$ , beginning at the point  $(2a, 0, 0)$  and going at first below the  $z$ -plane. 7
- (b) Evaluate  $\iint_S (y^2 z^2 \hat{i} + z^2 x^2 \hat{j} + x^2 y^2 \hat{k}) \cdot d\vec{S}$  over the surface  $x^2 + y^2 + z^2 = 1$  in the first octant. 8

**SECTION-B**

3. (a) Find the Fourier series expansion for  $f(x)$ , if

$$f(x) = -\pi, \quad -\pi < x < 0$$

$$= x, \quad 0 < x < \pi.$$

Deduce that  $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$ . 10

- (b) If  $f(t) = t \sin \omega t$ , find  $L(f)$ . 5

4. (a) Solve the initial value problem with Laplace transform

$$y'' + 4y' + 3y = 0, \quad y(0) = 3, \quad y'(0) = 1. \quad 7$$

- (b) Find the Fourier transform of

$$f(x) = \begin{cases} 1-x^2 & , \quad |x| \leq 1 \\ 0 & , \quad |x| > 1. \end{cases}$$

Hence evaluate  $\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$ . 8

### SECTION-C

5. (a) Find complete solution of the differential equation

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - v^2) y = 0,$$

where  $v$  is the parameter.

- (b) Prove that

$$\int_{-1}^1 P_m(x) P_n(x) dx = \begin{cases} 0 & , m \neq n \\ \frac{2}{2n+1} & , m = n. \end{cases}$$

6. (a) Use the method of Frobenius to find solutions near  $x = 0$  of the differential equation

$$2x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - 3) y = 0.$$

- (b) Prove that  $e^{x/2} \left( t - \frac{1}{t} \right) = \sum_{v=-\infty}^{\infty} t^v J_v(x).$

### SECTION-D

7. (a) Derive the one-dimensional wave equation :

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}.$$

- (b) An insulated rod of length  $l$  has its ends A and B maintained at  $0^\circ\text{C}$  and  $100^\circ\text{C}$  respectively until steady state conditions prevail. If B is suddenly reduced to  $0^\circ\text{C}$  and maintained at  $0^\circ\text{C}$ , find the temperature at a distance  $x$  from A at time  $t$ .

- (e) Find the Laplace transform of

$$\sin 2t \cdot \delta(t - \pi/4) - t^2 \delta(t - 4).$$

- (f) Prove that  $\int_{-1}^1 P_n(x) dx = 2$ , if  $n = 0$  and  $\int_{-1}^1 P_n(x) dx = 0$  if  $n \geq 1$ .

- (g) Show  $\frac{d}{dx} [x^{-v} J_v(x)] = -x^{-v} J_{v+1}(x).$

- (h) Prove  $P_n(x) = \frac{1}{2} \frac{d^n}{dx^n} (x^2 - 1)^n.$

- (i) Classify the wave equation in one dimension, heat equation in one dimension and heat equation in two dimensions. Also write mathematical condition.
- (j) Discuss the comparative advantage of product method for solving wave equation in one dimension, heat equations in one dimension and two dimensions in comparison to the method where general solution is found first.

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[Total No. of Printed Pages : 6]

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**B.Tech. IInd Semester Examination**  
**Applied Mathematics-II**  
**Paper - AS-1006**

**Time Allowed : 3 Hours**

**Maximum Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary / continuation sheet will be issued.

- Note :** i) Candidates are required to attempt Five questions in all selecting One question from each of the Section A, B, C and D and all the subparts of question in Section E.  
ii) Use of non-programmable calculators is allowed.

**Section - A**

1. a) Find the curvature and torsion of the helix. (08)  
 $x = a \cos t, y = a \sin t, z = bt.$

- b) Evaluate  $\iint_S \vec{F} \cdot \hat{n} dS$ , where  $\vec{F} = z\hat{i} + x\hat{j} - 3y^2z\hat{k}$  and S is the surface of the cylinder  $x^2 + y^2 = 16$  included in the first octant between  $z = 0$  and  $z = 5$ . (07)

2. a) Evaluate  $\iint_S \nabla \times \vec{E} \cdot d\vec{S}$  where (08)  
 $\vec{E} = (2y^2 + 3z^2 - x^2)\hat{i} + (2z^2 + 3x^2 - y^2)\hat{j} + (2x^2 + 3y^2 - z^2)\hat{k}.$

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Over the part of the sphere

$$x^2 + y^2 + 2az - 2ax = 0, z \geq 0.$$

- b) State divergence theorem and verify it for the given vector. (07)

$$\vec{F} = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$$

over the rectangular parallelepiped  $0 \leq x \leq a, 0 \leq y \leq b, 0 \leq z \leq c.$

**Section - B**

3. a) Find the Fourier series of

$$f(x) = \begin{cases} x & \text{if } -\pi/2 < x < \pi/2 \\ \pi - x & \text{if } \pi/2 < x < 3\pi/2 \end{cases} \quad (10)$$

- b) Find the inverse transform of  $\frac{s}{s^4 + 4a^4}$ . (05)

4. a) Solve  $(D^2 + n^2)x = a \sin(nt + \alpha), x = Dx = 0$  at  $t=0$  with the help of Laplace transform. (07)

- b) Find the Fourier transform of

$$f(x) = \begin{cases} 1 & \text{for } |x| \leq 1 \\ 0 & \text{for } |x| > 1 \end{cases}$$

Hence evaluate  $\int_0^\infty \frac{\sin x}{x} dx$ . (08)

## Section - C

5. a) Find the complete solution of the differential equation. (10)

$$(1-x^2)y'' - 2xy' + n(n+1)y = 0$$

and show that solutions are independent.

- b) Show that  $J_{-v}(x) = (-1)^v J_v(x)$  where  $J_v$  is the Bessel function of the first kind of order  $v$ . (05)

6. a) Find the series solution of differential equation.

$$x^2 \frac{d^2 y}{dx^2} + \frac{dy}{dx} + xy = 0. \quad (08)$$

- b) Show that

$$(1-2xt+t^2)^{-1/2} = \sum_{n=0}^{\infty} t^n P_n(x). \quad (07)$$

## Section - D

7. a) Derive heat equation in one dimension (06)

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}.$$

- b) An elastic string is stretched between two points at a distance  $l$  apart. One end is taken as the origin and at a distance  $\frac{2l}{3}$  from the end, the string is

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displaced a distance  $a$  transversely and is then released from rest when in this position. Obtain  $y(x,t)$ , the vertical displacement, if  $y$  satisfies the

$$\text{differential equation, } \frac{\partial^2 y}{\partial x^2} = c^2 \frac{\partial^2 y}{\partial t^2}. \quad (09)$$

8. a) Derive the heat equation in two dimension. (06)

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0.$$

- b) The diameter of semi-circular plate of radius  $a$  is kept at  $0^\circ\text{C}$  and the temp at the semi-circular boundary is  $T^\circ\text{C}$ . Show that the steady state temperature in the plate is given by

$$u(r,\theta) = \frac{4T}{\pi} \sum_{n=1}^{\infty} \frac{1}{(2n-1)} \left(\frac{r}{a}\right)^{2n-1} \sin(2n-1)\theta. \quad (09)$$

## Section - E (Compulsory)

9. a) The necessary and sufficient condition for the vector  $\vec{a}(t)$  to have constant magnitude is  $\vec{a} \cdot \frac{d\vec{a}}{dt} = 0$ .

(04)

- b) Show  $\nabla f$  is vector normal to the surface  $f(x,y,z) = c$  where  $c$  is a constant. (04)

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- c) Evaluate  $\int_C \vec{F} \cdot d\vec{r}$  where  $\vec{F} = \hat{i} \cos y - \hat{j} x \sin y$  and  $C$  is the curve  $y = \sqrt{1-x^2}$  in the  $xy$ -plane from  $(1,0)$  to  $(0,1)$ . (04)

- d) The function is defined as

$$f(x) = \phi(x), \quad \alpha < x < c$$

$$= \psi(x), \quad c < x < \alpha + 2\pi$$

Write the formulae for  $a_0$ ,  $a_n$  and  $b_n$  where the symbols have the usual meaning. (04)

- e) Find the inverse transforms of

$$\frac{se^{-s/2} + \pi e^{-s}}{s^2 + \pi^2} \quad (04)$$

- f) Express  $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$  in terms of Legendre polynomials. (04)

- g) Show  $\frac{d}{dx} [x^v J_v(x)] = x^v J_{v-1}(x)$ . (04)

- h) Prove  $P_n(x) = \frac{1}{n!} \frac{d^n}{dx^n} (x^2 - 1)^n$ . (04)

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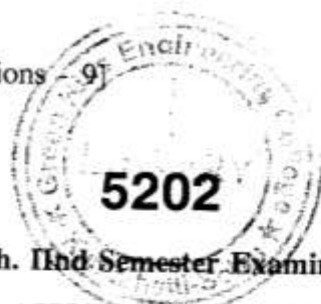
- i) Classify the wave equation in one dimension, heat equation in one dimension and heat equation in two dimensions. Also write mathematical condition. (04)

Discuss the comparative advantage of product method for solving wave equation in one dimension, heat equations in one dimension and two dimensions in comparison to the method where general solution is found first. (04)

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Total No. of Questions - 9  
(2057)

Total Pages : 2



B.Tech. III<sup>rd</sup> Semester Examination

APPLIED PHYSICS-II

Paper - AS-1007

Time : Three Hours]

[Maximum Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all, selecting one question each from Sections A, B, C and D. Section E is compulsory.

#### SECTION-A

1. (i) Explain Laue method of X-ray diffraction. 10  
(ii) Calculate minimum voltage that must be applied to an X-ray tube to produce X-ray photon of  $\lambda \approx 1^\circ \text{A}$ . 5
2. (i) How Quantum theory of free electron is different from that of Classical theory ? 10  
(ii) Define Density of state and Fermi level. 5

#### SECTION-B

3. Classify metals, insulators and semi-conductors on the basis of energy band by taking into account the Fermi level. 15

4. On the basis of Kronig and Penney model, explain energy band by taking delta function. 15

#### SECTION-C

5. (i) Explain the difference between Type-I and Type-II superconductors. 8  
(ii) Write important applications of Superconductor. 7
6. By taking into account Molecular field theory, explain ferromagnetism. 15

#### SECTION-D

7. What is the difference between Optical communication through open space and waveguides ? 15
8. Distinguish between Single mode and Multimode fibres. 15

#### SECTION-E

9. Answer all the questions :
  - (a) What is the cause of diamagnetism ?
  - (b) Explain Fermi Dirac distribution.
  - (c) Mention the importance of magnetic circuit.
  - (d) Explain Thermionic emission.
  - (e) Define Spontaneous and Stimulated emission.
  - (f) How paramagnetism behaviour changes with temperature ?
  - (g) Write the applications of fibre optics.
  - (h) Define Effective mass. 8×5=40

[Total No. of Questions : 91]  
(2058)

[Total No. of Printed Pages : 2]



**B.Tech. IInd Semester Examination**

**Applied Physics-II**

**Paper-AS-1007**

**Time Allowed : 3 Hours**

**Maximum Marks : 100**

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary / continuation sheet will be issued.*

**Note :** Attempt Five questions in all, selecting One from each of Section-A, B, C and D of the question paper and all the subparts of the questions in Section E

**Section - A**

1. Drive Richardson Dushman equation. (15)
2. Explain powder diffraction method by using simple crystal structure. (15)

**Section - B**

3. Explain brillouin zone by taking into account square lattice in K space. (15)
4. Describe E-K diagrams in details. (15)

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**Section - C**

5. Write short note (15)
  - i) Hall effect
  - ii) Photo conductivity.
6. Explain ferromagnetism on the basis of Domain theory. (15)

**Section - D**

7. Write down the importance of gas Laser and also explain He-Ne Laser in details. (15)
8. Explain optical communication through wave guides. (15)

**Section - E**

9.
  - i) Explain the cause of paramagnetism.
  - ii) What is the effect of temperature on diamagnetism?
  - iii) Define Numerical Aperture.
  - iv) How is lattice different from crystal?
  - v) What is the cause of super conductivity?
  - vi) Define spin and orbital magnetic moment.
  - vii) What is meant by coherence?
  - viii) Write down the characteristics of photo voltaic cell. (8×5=40)

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**B.Tech. IInd Semester Examination**

**APPLIED PHYSICS-II**

Paper : AS-1007

Time : Three Hours]

[Maximum Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all, selecting *one* question from each Section A, B, C and D. Section E is compulsory.

**SECTION-A**

1. (a) With a neat diagram describe the powder method to determine the crystal structure.
- (b) Draw a (111) plane and a (222) plane in the unit cell of a cubic lattice with lattice parameter  $a$ . Determine their distances from a parallel plane through the origin. (10, 10)

2. (a) Show that the density of states function for a two dimensional system of free particles in a rigid container of area  $A$  is given by  $4\pi mA/h^2$ . Hence determine the fermi energy at absolute zero for this system.
- (b) Write the Fermi-Dirac distribution function. Graphically show its variation with energy at absolute zero and at finite temperature. Hence define fermi energy. (12, 8)

**SECTION-B**

3. (a) Using Kronig-Penney Model, discuss qualitatively the origin of energy bands in solids. On the basis of band theory of solids distinguish between conductors, semiconductors and insulators; give one example of each.
  - (b) A two-dimensional square lattice has a side of 0.3 nm. Sketch the first two Brillouin zones for this lattice. (12, 8)
4. (a) Show that the effective mass of an electron in crystal is inversely proportional to the second derivative of the  $E$ - $K$  curve. Discuss the condition when the effective mass of an electron becomes positive, negative and infinity.
  - (b) Show graphically the location of fermi level for an intrinsic semiconductor,  $p$ -type semiconductor and  $n$ -type semiconductor. (12, 8)

### SECTION-C

5. Describe the principle, construction and working of a photovoltaic cell. Give its important characteristics. (20)
6. (a) Discuss the origin of Diamagnetism and derive an expression for diamagnetic susceptibility.
- (b) To which class of Magnetism the superconductors belong, explain. Give three important characteristics of superconductor. (12, 8)

### SECTION-D

7. (a) Distinguishing between spontaneous and stimulated emission processes, give the principle of laser action. Describe two important characteristics of a laser beam.
- (b) Give the construction, working and uses of He-Ne laser system. (10, 10)
8. What is meant by Numerical Aperture and Acceptance Angle of an optical fibre ? Derive expression for these. Describe the factors responsible for attenuation and distortion of optical signal passing through a fibre. (20)

### SECTION-E

#### (Compulsory Question)

9. (a) Define the terms - Crystal, Lattice and Unit cell.
- (b) Describe different types of Bondings in solids, giving one example of each type.

- (c) Explain why the electrons are treated as free particle in Free electron model while these are actually confined in the metal.
- (d) Give graphically the variation of number density function as a function of energy at absolute zero and at finite temperature.
- (e) What are Brillouin zones ? Explain.
- (f) Discuss the variation of Photoconduction current with the intensity of radiation.
- (g) Distinguish between Diamagnetic, Paramagnetic and Ferromagnetic materials on the basis of susceptibility.
- (h) What are Magnetic circuits ? Explain.
- (i) Explain the concept of Population inversion.
- (j) Distinguish between Single mode and Multimode fibres. (2×10=20)

2. a) Define rms value and average value of an a.c. sinusoidal voltage and establish relation between them. Obtain these values for a sinusoidal voltage  $v$ .

$$v = V_m \sin \omega t. \quad (10)$$

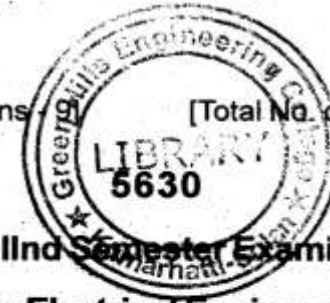
- b) A coil when connected a 110V d.c. supply dissipates 500 W of power. When connected across a 110 Volts a.c. supply at frequency of  $50 \text{ Hz}$ , dissipates 220 watts. What is the value of resistance (R) and inductance (L) of the coil? (10)

### Section - B

3. a) Define resonance in series a.c. circuit and Q - factor of the above circuit. Derive a relation between the Q - factor,  $b$  and with and resonant frequency of a series a.c. circuit. (10)
- b) A coil of resistance  $100 \Omega$  and inductance  $100 \mu \text{H}$  is connected in series with a  $100 \text{ pF}$  - capacitor. The circuit is connected to a 10 volts variable frequency source. Calculate
- The resonant frequency
  - The current at resonance &

[Total No. of Questions  
(2058)]

[Total No. of Printed Pages : 6]



### B.Tech. II<sup>nd</sup> Semester Examination Basic Electrical Engineering

Paper - EE - 1001

Time Allowed : 3 Hours

Maximum Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

**Note :** Candidates must attempt **One** question each from Sections A, B, C and D and the **entire** Section - E.

### Section - A

1. a) Define and explain Kirchhoff's laws and discuss their applications to Nodal and Mesh - analysis in a d.c. circuit. (10)
- b) Formulate the Kirchhoff's voltage law equations for the circuit shown in Fig - 1. Obtain values of currents  $I_1$ ,  $I_2$  and  $I_3$ . (10)

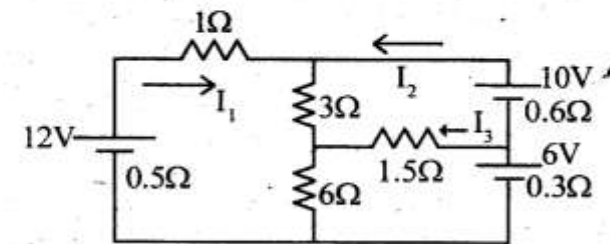


Fig 1 A d.c Circuit with  $I_1$ ,  $I_2$  &  $I_3$

iii) Q - factor of the circuit. (10)

4. a) Establish relations between the phase voltage and line voltage and phase current and line current in case of
- i) balanced star connection and
  - ii) balanced delta - connection. (10)
- b) Calculate the phase and line currents in a balanced delta connected load taking 75 K watts at a power factor of 0.80 from on 3 - phase, 440V, 50Hz supply. (10)

#### Section - C

5. a) Discuss working principle of a two - winding transformer and develop its phasor diagram. (10)
- b) Determine the regulation of a transformer in which ohmic loss is 1% of the output and the reactance drop 5% of the voltage when power factor is 0.80 lagging. (10)
6. a) Describe the construction of a d.c. machine and explain what materials are used for each component of the machine. Derive emf equation of a d.c. generator. (10)
- b) A 4 - pole d.c. generator has a flux of 40 m web/pole and lap connected armature with 740 -

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conductors. Determine the emf generated on open ckt. at 1000 rpm. (10)

#### Section - D

7. a) Give classification of measuring instruments. Discuss principle of operation, construction main features and applications of a moving coil instrument. (10)
- b) A moving coil instrument has a full scale deflection of 1 mA and a resistance of  $50\Omega$ . Find the resistances  $R_1$ ,  $R_2$  and  $R_3$  for converting it into a multirange voltmeter of ranges 1.5V, 5V & 10V. (10)
8. a) Discuss charging and Discharging of storage batteries. (10)
- b) It is desired to charge a 12V car - battery from 230 V d.c. source at 6 ampere. The d.c. source and battery are connected in series with a group of 60 watt, 220V - bulbs in parallel. How many lamps will be required for the above purpose? (10)

#### Section - E

9. Answer the following short questions : (10×2=20)
- a) Define watt - hour efficiency of a secondary cell and relate the above efficiency to Ampere - hour efficiency.

- h) Obtain impedance of the circuit shown in Fig 3 below :

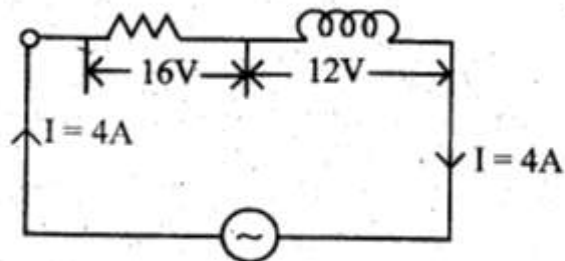
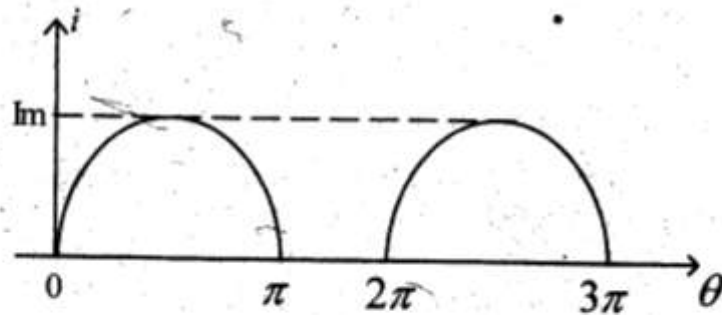


Fig 3 An a.c. circuit

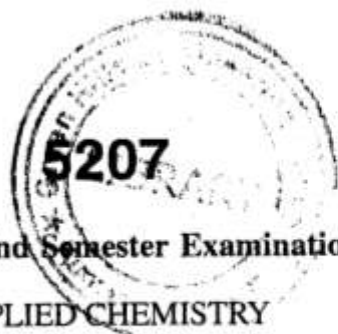
- i) A half wave rectified a.c. wave is shown in Fig 4 below:  
Obtain its rms value average value and form factor.



- j) Using a simple d.c. circuit, state superposition theorem & explain its significance.



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B.Tech. IInd Semester Examination

APPLIED CHEMISTRY

Paper - AS-1004

Time : Three Hours]

[Maximum Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all, selecting one question each from Sections A, B, C and D. Section E is compulsory.

**SECTION-A**

1. (a) Derive Gibbs Helmholtz equation. 10
- (b) 1 mole of ideal gas ( $C_v = 12.471 \text{ JK}^{-1} \text{ mol}^{-1}$ ) is heated from 300 K to 600 K. Calculate entropy change when
  - (i) Volume is kept constant.
  - (ii) Pressure is kept constant. 5
- (c) What is the significance of the statement that free energy of the reaction is zero ? 5

2. (a) What is Condensed phase rule ? Construct the phase diagram of Lead-Silver system and explain the following terms :
  - (i) The Eutectic point.
  - (ii) Pattinson's process of desilverisation. 3, 9
- (b) Define the following terms :
 

Phase, Component, Triple point, Metastable triple point. 8

**SECTION-B**

3. (a) How temporary hardness of a water sample can be determined by EDTA method ? 10
  - (b) A water sample was alkaline to both phenolphthalein and methyl orange. 100 ml of this water sample required 30 ml of  $N/50\text{-H}_2\text{SO}_2$  for phenolphthalein end point and another 20 ml for complete neutralisation. Determine the types and extent of alkalinity present. 5
  - (c) What is Boiler corrosion ? How it can be controlled ? 5
4. (a) What are the factors which affect corrosion ? 10
  - (b) What are the sources of Radioactive pollution ? How waste of this can be disposed off ? 10

**SECTION-C**

5. (a) Discuss Boundary lubrication and compare it with Hydrodynamic lubrication. 10
- (b) Define the terms - Acid value, Saponification value and Viscosity index. Also give their significance in lubrication. 10

6. (a) Name the parameters, which can be determined in proximate and ultimate analysis of coal. How proximate analysis can be done ? What is its significance ? 10
- (b) What is Water gas ? Give its preparation and properties. 10

### SECTION-D

7. (a) What is Catalysis ? Discuss Homogeneous and Heterogeneous catalysis with examples. 8
- (b) What are Absorption laws ? 6
- (c) Predict the no. of proton signals and their spin spin splitting for the following compounds :
- (i)  $\text{CH}_3\text{CH}_2\text{OH}$
- (ii)  $\text{CH}_3-\text{CH}_3$
- (iii)  $\text{CH}_2=\text{CH}-\text{CH}_2\text{OH}$  6
8. (a) What are Semiconductors ? What are their types ? 8
- (b) How will you distinguish between two compounds in each of the following pairs on the basis of IR spectroscopy :
- (i)  $\text{CH}_3-\text{CH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$  and  $\text{CH}_2=\text{CH}-\text{O}-\text{CH}_3$
- (ii)  $\text{CH}_3-\text{COOH}$  and  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$  6
- (c) What are the characteristic features of Enzyme catalysed reactions ? 6

### SECTION-E

#### (Compulsory)

9. Answer all the questions in brief :
- (a) What is the difference between Critical point and Triple point ? 3
- (b) Define BOD and COD. Also give the significance of these terms. 3
- (c) What is Grease ? Compare Lithium grease with Soda grease. (
- (d) Why bolts and nuts made of the same metal are preferred in practice ? 3
- (e) Why Gaseous fuel are more advantageous than Solid fuel ? 2
- (f) Which of the following transitions require maximum energy :
- $\sigma-\sigma^*, \pi-\pi^*, n-\pi^*, n-\sigma^*$  2
- (g) How Calpeyron-Clausius equation (No derivation is required) has been used for studying the effect of temperature on the vapour pressure of a liquid ? 2
- (h) What is the principle of Mass spectroscopy ? 2

[Total No. of Questions - 9]  
(2058)

[Total No. of Printed Pages : 4]

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B.Tech. IInd Semester Examination

Applied Chemistry

Paper - AS-1004

Time Allowed : 3 Hours

Maximum Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary / continuation sheet will be issued.

**Note :** Attempt five questions in all, selecting **One** question from each section A, B, C & D. Section E is compulsory.

**Section - A**

- I. a) Derive clapeyron - Clausius Equation. Explain how this equation can be used for
- i) To study the effect of pressure on the boiling point of a liquid. (10)
- b)  $\Delta H$  and  $\Delta S$  for the vaporisation of water at 1 atm. Pressure are 40.63 KJ mol<sup>-1</sup> and 108.8 JK<sup>-1</sup> mol<sup>-1</sup> respectively. Calculate the temperature at which the free energy change for this transformation will be zero. Predict, giving reasons, the sign of free energy change ( $\Delta G$ ) above this temperature. (10)

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[P.T.O.]

(2)

5627

- II. a) Draw phase diagram of water system and explain why at higher pressure fusion curve in the phase diagram inclined toward lower temp or inward? (10)
- b) Define Phase Rule. Explain all the terms involved in it. (10)

**Section - B**

- III. a) How can permanent hardness of water be determined? Give only one method. (10)
- b) What are the various sources of air pollution? Discuss the harmful effects of
- i) Nitrogen oxide ii) CO. (10)
- IV. a) Define the terms BOD and COD. How BOD can be determined experimentally? Give its significance in assessing pollution level. (10)
- b) Explain the followings. (10)
- i) Electrochemical Corrosion
- ii) Cathodic Protection.

**Section - C**

- V. a) Explain the following properties of the Lubricants and give their significance.
- i) Viscosity Index
- ii) Cloud point and pour point
- iii) Flash & fire point
- iv) Acid Value. (10)
- b) What is Reforming of Petrol? How does reforming increase the octane No. Give any two reforming reactions. (10)

- VI. a) What is Oiliness? Discuss the mechanism of Boundary Lubrication. (10)
- b) What is Cracking of fuel? Discuss in detail Catalytical Cracking. (10)

#### Section - D

- VII. a) Differentiate the followings. (10)
- Homogenous and Heterogenous catalysis.
  - Physical Adsorption and Chemical Adsorption.
- b) i) Explain the principle of proton magnetic resonance spectroscopy. (05)
- ii) What type of Transitions can be studied under UV spectroscopy? (05)
- VIII. a) How many NMR signals you will get in the following cases.
- $\text{CH}_3\text{CHO}$
  - $\text{CH}_3\text{COCH}_3$
  - $\text{CH}_2=\text{CH}-\text{CH}_2\text{OH}$
  - $\text{CH}_3-\text{CH}_3$  (10)
- b) What are P and N - type Semiconductors? (10)

[P.T.O.]

#### Section - E

- IX. a) What is Eutectic mixture? Give its two applications. (03)
- b) What are the reasons of Boiler corrosion? (03)
- c) How radioactive waste can be disposed off? (03)
- d) What is the criteria of catalysis? (03)
- e) Which parameters can be determined under proximate analysis of Coal? (02)
- f) What is the relationship between change of energy and quantity of heat? (02)
- g) What is the principle of estimating dissolved  $\text{O}_2$  from water sample? (02)
- h) Define Chemical Shift and Coupling Constant. (02)



Total No. of Questions : 9]  
(2069)

Total Pages : 4



**B.Tech. IInd Semester Examination**

**APPLIED CHEMISTRY**

Paper : AS-1004

Time : Three Hours]

[Maximum Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all, selecting *one* question each from Sections A, B, C and D. Section E is compulsory.

**SECTION-A**

1. (a) What is Allotropy ? Explain phase diagram of a system showing allotropic behaviour. 12  
(b) Define the following terms :  
Phase, Component, Degree of freedom, and Triple point. 8
2. (a) Derive Clapeyron-Clausius equation for liquid-vapour system. 10

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[P.T.O.]

- (b) Vapour pressure of water at 95° and 100°C are 634 and 760 mm, respectively. Calculate the molar heat at vapourization,  $\Delta H_v$ , of water between 95° and 100°C. 5
- (c) What is the significance of the statement of Second Law of Thermodynamics : "It is impossible to convert heat into work without compensation." ? 1

**SECTION-B**

3. (a) How the hardness of water is removed by soda-lime process ? Write down the reactions required. 10  
(b) Explain the different problems of boiler due to use of polluted water. What are their disadvantages ? 10
4. (a) Define Corrosion. Explain the different mechanisms of corrosion. 10  
(b) Differentiate between BOD and COD, with examples. 5  
(c) What is Green House effect ? How does it effect the earth's environment ? 5

**SECTION-C**

5. (a) What is Lubrication ? Describe different mechanisms of lubrication. 10  
(b) What are Solid lubricants ? Why are they used ? Give details about graphite. 10

5007/1700/GGG/147

2

6. (a) What is theory of formation of coal ? Describe it. 10.  
 (b) Explain the gross and net calorific values of fuels. 5.  
 (c) What is Producer gas ? How are they prepared ?  
 Write different reactions occurring during the preparation of producer gas. 5

### SECTION-D

7. (a) What is basic theory of NMR ? In the NMR spectroscopy, describe the following :  
 (i) Spin number.  
 (ii) Precessional frequency.  
 (iii) Gyromagnetic constant.  
 (iv) Spin-lattice relaxation. 10  
 (b) Define the following in NMR with examples :  
 (i) Chemical shift.  
 (ii) Anisotropic effect. 6  
 (c) Predict the multiplicities of the signals in the proton NMR spectra of 1,3-dichloropropane and 1,1,3,3-tetrachloropropane. 4
8. (a) What is Fermi energy level ? Where does it lie in  
 (i) Intrinsic semiconductor, (ii) *p*-type semiconductor and (iii) *n*-type semiconductor ? 10  
 (b) What is the importance of enzyme catalysis ?  
 Derive a kinetic equation for enzyme catalyzed reaction ? 10

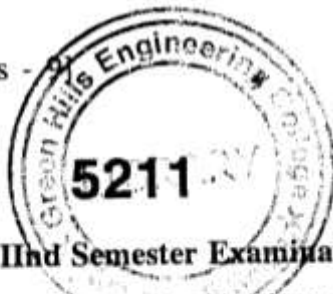
### SECTION-E

9. (a) Polycrystals are isotropic in nature. Comment  
 (b) Calculate entropy change accompanying the transfer of 10460 joules of heat from a body A at 300°C to a body B at 77°C.  
 (c) Why does magnesium bicarbonate require double amount of lime for softening ?  
 (d) What is the importance of rancidity ?  
 (e) Why magnesium bars are bolted along the sides of ships near the bilge keel ?  
 (f) How the X-rays are generated ?  
 (g) Why the emulsion of oil in water is used as cutting emulsions ?  
 (h) How do IR spectra originate ?  
 (i) What is Catalytic poisoning ?  
 (j) What is the application of Pattinson's process ?

2×10=20 (

Total No. of Questions - 9  
(2057)

Total Pages : 4



**B.Tech. IInd Semester Examination**  
**BASIC MECHANICAL ENGINEERING**  
Paper – ME-1003

Time : Three Hours]

[Maximum Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all, selecting one question each from Sections A, B, C and D, and Q. No. 9 of Section E (Compulsory). Assume missing data suitably, if any.

**SECTION-A**

1. (a) Derive an expression for work done in a adiabatic expansion, reversible non-flow process. 16  
(b) Define Enthalpy. How is it related to internal energy ? 4
2. (a) A perfect gas flows through a nozzle, where it expands in a reversible adiabatic manner. The inlet conditions are 22 bar, 580°C, 38 m/s. At exit, the pressure is 2 bar. Determine the exit velocity and exit area if the flow rate is 4 kg/s.  
Take  $R = 190 \text{ J/kg-K}$  and  $\gamma = 1.35$ . 16  
(b) What is Steady flow process ? State all the assumptions made for such a flow process. 4

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[P.T.O.]

**SECTION-B**

3. A Carnot cycle works with isentropic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of the isothermal expansion is  $0.3 \text{ m}^3$ . If the maximum temperature and pressure is limited to 550 K and 21 bar, determine (i) minimum temp. in the cycle, (ii) thermal efficiency of cycle, (iii) pressure at all salient points, (iv) change of entropy during isothermal expansion, and (v) work done per cycle.  
Take ratio of specific heats ( $\gamma$ ) = 1.4. 20
4. (a) Show that COP of a heat pump is greater than COP of a refrigerator by unity. 8  
(b) Comment on the statement 'The entropy of the universe tends to be maximum.' 4  
(c) Derive an expression for efficiency of Carnot cycle. 8

**SECTION-C**

5. A cantilever beam of length 2 m carries a uniformly distributed load of 1.5 kN/m run over the whole length and a point load of 2 kN at a distance of 0.5 m from the free end. Draw the Shear force and Bending moment diagrams for the cantilever. 20
6. (a) Determine the changes in length, breadth and thickness of a steel bar which is 4 m long, 30 mm wide and 20 mm thick and is subjected to an axial pull of 30 kN in the direction of its length.

Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and Poisson's ratio = 0.3

8

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2

- (b) A steel rod of 3 cm diameter and 5 m long is connected to two grips and the rod is maintained at a temp. of  $95^{\circ}\text{C}$ . Determine the stress and pull exerted when the temp. falls to  $30^{\circ}\text{C}$ , if
- the ends do not yield, and
  - the ends yield by 0.12 cm.
- Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $\alpha = 12 \times 10^{-6}/^{\circ}\text{C}$ .

12

#### SECTION-D

7. Two shafts of same material and of same lengths are subjected to the same torque. If the first shaft is of a solid circular section and the second shaft is of hollow circular section, whole internal diameter is  $2/3$  of the outside diameter and the maximum shear stress developed in each shaft is same, compare the weights of the shafts. 20
8. (a) Derive the bending equation for a beam. 10  
 (b) Derive an expression for maximum torque transmitted by a circular solid shaft. 10

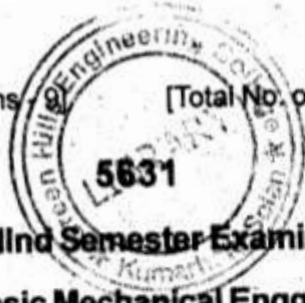
#### SECTION-E (Compulsory)

9. Answer *all* the following in brief :
- Differentiate between Closed system and Open system.
  - Differentiate between Non-flow process and a Flow process.
  - Draw P-V and T-S diagrams of Carnot cycle.

- Explain the difference between intensive and extensive properties of a system.
- Define Kelvin, Planck and Clausius statements.
- What are the different types of beams ?
- Define clearly the different types of stresses and strains.
- Define Poisson's ratio.
- What do you understand by "Strength of a Shaft" ?
- Define the term : Bending stress in a beam and Section modulus.  $2 \times 10 = 20$

[Total No. of Questions : 9]  
(2058)

[Total No. of Printed Pages : 4]



**B.Tech. II Semester Examination**

**Basic Mechanical Engg.**

**Paper - ME-1003**

**Time Allowed : 3 Hours**

**Maximum Marks : 100**

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary continuation sheet will be issued.*

**Note :** Attempt **Five** questions in all, selecting **One** question from each of the sections A, B, C, and D and **all the subparts** of section E. Use of non-programmable calculator is allowed. Assume suitable missing data, if any.

**Section - A**

- I. 0.9Kg of gas at 1 bar and  $15^{\circ}\text{C}$  is compressed isentropically to 4 bar. The volume changes from  $0.75\text{ m}^3$  to  $0.28\text{ m}^3$ . Find the value of gas constant and specific heat at constant pressure. Also find change in internal energy. (20)
- II. Air compressor takes in air at 1 bar and  $20^{\circ}\text{C}$  and discharges into a line of inside diameter 10 mm at pressure 3 bar with velocity  $7.7\text{ ms}^{-1}$ . The compression is isentropic, calculate the work input assuming the inlet velocity to be very small. (20)

(2)

5631

**Section - B**

- III. State the Kelvin - Planck and Clausius statements of the second law of thermodynamics and prove their equivalence. (20)
- IV. A reversible heat engine is supplied 900 KJ of heat from a heat source at 500K. The engine develops 300KJ of net work and rejects heat to two heat sinks at 400K and 300K. Determine the engine thermal efficiency and magnitude of heat interaction with each of the sink. (20)

**Section - C**

- V. A metallic bar of 50 mm diameter is subjected to a tensile load of 100 kN. The extension over its 300 mm length was found to be 0.08 mm and change of its diameter was 0.0035 mm. Determine the modulus of rigidity of the bar material. (20)
- VI. A simply supported beam is loaded as shown in Fig - I. Draw the shear force and bending moment diagrams and determine the maximum bending moment along with its location. (20)

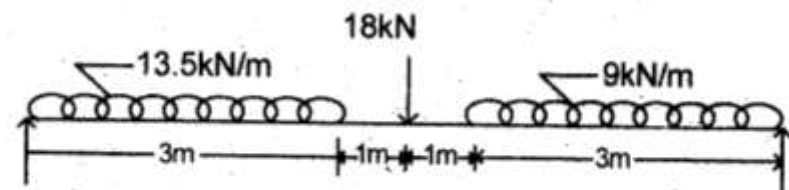


Fig - I

**Section - D**

- VII. A beam is of square section of side ' $a$ '. If the maximum allowable bending stress is ' $\sigma$ ', find the moment of resistance when the beam section is placed such that
- two sides are horizontal
  - one diagonal is vertical
- (20)
- VIII. Two shafts of the same material and same length, one solid and the other hollow are to be designed for transmission of torque. The ratio of diameters in case of hollow shaft is to be 0.75. If the two shafts have to carry the same maximum stress, calculate the saving in weight in case of hollow shaft. (20)

**Section - E**

- IX. a) Define enthalpy. How is it related to internal energy?
- b) State the limitations of first law of thermodynamics.
- c) Explain what you understand by the term 'free expansion'.
- d) What is the difference between adiabatic process and isentropic process?
- e) State the third law of thermodynamics.
- f) Define coefficient of performance.
- g) State the difference between heat engine and heat pump.
- h) Define internal energy. Is it a state function or process function?

[P.T.O.]

- Define an isolated system.
- What is perpetual motion machine of second order? Why such a machine cannot be made in actual practice?
- What is Poisson's ratio? What is its value range for common engineering materials?
- Define 'Elastic Limit' and 'Young's modulus'.
- Explain briefly the difference between stress - strain curves of mild steel and aluminium.
- Define thermal stress. State the expression for thermal stress in a bar whose ends are fixed rigidly.
- Define 'shear force' and 'bending moment' in beams.
- Based on the type of supports, name different types of beams.
- Define 'Section modulus' and 'moment of resistance of a section'.
- Differentiate between a beam and a shaft.
- State the assumptions made in deriving torsion equation for a shaft of circular section.
- Explain what you understand from the term 'torsional rigidity'. (20×1=20)

