Total No. of Pages: 2 *Roll No.....*

SECOND SEMESTER **B. Tech. [All Groups]**

MID SEMESTER EXAMINATION ***March 2019***

AP102: PHYSICS-II

Time: 1.5 Hours ***Max. Marks: 30***

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

1 [a] Consider a particle trapped in an infinite potential box of width a,

$$V(x) = \begin{cases} 0, & 0 < x < a \\ \infty, & x \leq 0, x \geq a \end{cases}$$

Write the Schrodinger equation for this particle and hence get the expressions for the energy eigen values and energy eigen functions for the particle. Draw its fourth energy eigen function. 3

[b] Find the expectation value $\langle x \rangle$ and $\langle p_x \rangle$ of the position and momentum, respectively, of a particle trapped in one dimensional box of width a. Discuss the significance of the results. 3

2 [a] Show that the de Broglie wavelength of a particle of rest mass m_0 and kinetic energy KE is given by

$$\lambda = \frac{hc}{\sqrt{KE(KE + 2m_0c^2)}}$$ 3

[b] An electron is put in a cubical box of each side 1Å. Find the values of its momentum and energy for the ground state and first excited state. 3

3 [a] X-rays of wavelength 10 pm are scattered from a target. (I) Find the wavelength of the x-rays scattered through 45°. (II) Find the maximum wavelength present in the scattered x-rays. (III) Find the maximum kinetic energy of the recoil electrons. 3

[b] For copper the conductivity is 5.8×10^7 mhos/m and one may assume $\mu=\mu_0$. Find the skin depth or penetration depth at the frequencies of 100 Hz and 100 MHz. Explain the results physically. 3

P.T.O.

4 [a] Write the Maxwell's equations in their differential form and use them to deduce the integral form of the equations. Briefly explain the physical meaning of the Maxwell's equations.

[b] What is displacement current density $\vec{J_D}$ and explain how did Maxwell use the continuity equation to introduce the term $\vec{J_D}$ in order to modify the Ampere's law. Also explain, how did the introduction of the term $\vec{J_D}$ revolutionize the physics.

5 [a] Derive the wave equations for propagation of electric field $\vec{E}$ and magnetic field $\vec{H}$ in free space. Show that the $\vec{E}$ and $\vec{H}$ in plane electromagnetic waves are mutually perpendicular in a plane normal to the direction of wave propagation.

[b] Define Poynting vector $\vec{S}$. The electric field vector for an electromagnetic field travelling in vacuum is given by

$$\vec{E} = E_0 \cos(kz - wt)\,\hat{x}$$

Calculate the Poynting vector for the wave and show that its magnitude is equal to the energy density of the wave times the velocity of light.

END

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SECOND SEMESTER

B.Tech. [Gp B]

MID SEMESTER EXAMINATION

March-2019

AC-102 CHEMISTRY

Time: 1.5 Hours

Max. Marks: 30

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

1 Answer all the following questions [2×5]

[a] Distinguish between Iodimetry and Iodometry in volumetric analysis by taking suitable example.

[b] Mention various types of electronic transitions possible in the following molecules:

Methane, Ethene, Formaldehyde and Chloromethane.

[c] Draw the structure of phenolphthalein and name the functional groups present. Explain its solubility in water.

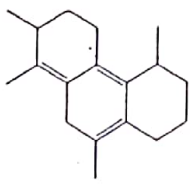
[d] Define glass transition temperature (T_g)? Give one example each of an exothermic and endothermic physical change.

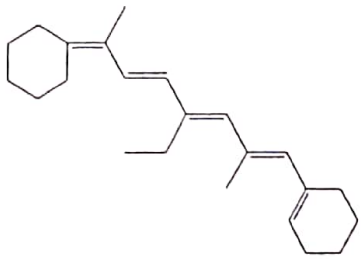
[e] Write possible IR frequencies for the following functional groups:

-OH, -NH, C=O and C≡N.

2 Explain the principle and thermograms of TGA. Write its four applications. [3+2]

3 Calculate λ_{max} for the following molecules using Woodward – Fieser rule: [1½+1½+2]

(i) 

(ii) 

Explain Finger print region and give source of IR radiations in IR spectrophotometer.

4 (a) Alkaline water sample (100 mL), on titration, required 14.5 mL of N/50 HCl upto phenolphthalein end point. When few drops of methyl orange are added to the same solution and titration further continued, the yellow colour of the solution just turned red after addition of another 10.5 mL of the acid solution. Elucidate the type of alkalinity present (i.e. ions responsible for causing alkalinity) and calculate their strength.

(b) Calculate the concentration in µg/mL of a solution of organic compound (mol. mass 211) giving an absorption of 0.612 at its λ_{max} 281 nm in 4 cm cell. The molar absorptivity at 281 nm is 5372.

[2.5 + 2.5]

5 Suggest and explain a suitable method for determination of hardness of water. Write down three conditions for a precipitation titration to take place. [3 + 2]

Total No. of Pages: 1 *Roll No.....*

II[nd] SEMESTER B. Tech. (Common for .

MID SEMESTER EXAMINATION (MARCH-2019)

MA 102: Mathematics-II

Time: 1:30 Hours Max. Marks: 25

Note: All questions are compulsory. All questions carry equal marks. Assume suitable missing data, if any.

Q1. Test the consistency and hence solve the following system of equations:

$$x+2y-z=3$$
$$3x-y+2z=1$$
$$2x-2y+3z=2$$
$$x-y+z=-1$$

Q2. Find the matrix A whose eigenvalues and corresponding eigenvectors are as follows:

Eigenvalues: $1,-1,2$; Eigenvectors: $(1,1,0)^T,(1;0,1)^T,(3,1;1)^T$

Q3. Find the general solution of the differential equation

$$\frac{d^2y}{dx^2}-\frac{6}{x^2}y=x\log x$$

Q4. By using the method of variation of parameters, find the general solution of the differential equation $\frac{d^2y}{dx^2}-n^2y=\sec nx$

Q5. Find the power series solution of the equation $(x^2+1)y''+xy'-y=0$ about the point $x=0$.

- END -

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FIRST SEMESTER B. TECH(All Branches)

MID SEMESTER EXAMINATION SEPT. 2018

ME101 Basic Mechanical Engineering

Time 1 Hour 30 Minutes Max. Marks: 25

Note: Answer ALL questions. Assume suitable missing data, if any. Part-A & Part-B should be written in the same answer book separately .

PART-A

Q 1. Explain briefly: closed system, open system and isolated system. (1.5)

Q 2. What are the intensive and extensive properties? Explain, with examples. (1.5)

Q 3. Convert the pressure of 10 cm Hg (Vacuum) into absolute pressure(kPa). [Barometer reading is 720 mmHg, density of Hg is 13600 kg/m^3]. (1.5)

Q 4. Show that energy is a property of a system. (2)

Q 5. Derive the expression of work done in isothermal and polytropic process. (2)

Q 6. A gas of mass 1.5 kg undergoes quasi-static expansion which follows a relationship

$$p = a + bV$$

Where, a and b are constants. The initial and final pressures are 1000 kPa and 200 kPa, respectively and corresponding volumes are 0.2 m^3 and 1.2 m^3. The specific internal energy(kJ/kg) of the gas is given by

$$u = 1.5pv - 85$$

Where, p is in kPa and v is in m^3/kg. Determine the heat transfer in the process. (4)

PART- B

Q 1 Differentiate between grey cast iron and nodular cast iron. (2)

Q 2 What is HSS? State the composition and applications of any one type of HSS. (2)

Q 3 Write short notes on the following

(a) Duralumin (b) Super alloys (2×2)

Q 4 Differentiate between double piece pattern and loose piece pattern. (2)

Q 5 What are the desirable properties of a good moulding sand? Explain briefly. (2.5)

END

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Ist SEMESTER B.Tech.

Mid TERM EXAMINATIONSeptember 2019

ME 101 BASIC MECHANICAL ENGG.

Time: 1.5 Hours Max. Marks: 25

Note:Part-A and Part-B are to be answered in the same answer sheet separetaly .
Do not mix the answer of part A and Part B.
Answer all questions from each part. Assume suitable missing data, if any.

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Part A

1. Explain the following: (i) path function (ii) point function. (1)
2. State first law of thermodynamics for a process and cycle. Derive expression for work done,heat transfer for a system undergoinga polytropic processPV^n=Constant. (2)
3. Write expressions for steady flow Mass and Energy Balance equations and apply the same for nozzle and diffuser considering assumptions made. (2)
4. 100 litres of an ideal gas at 300 K and 1 bar is compressed adiabatically to 10 bar. It is then cooled at constant volume and further expanded isothermally so as to reach the condition where it started. Draw the p-V diagram and calculate:

(i) Pressure at the end of constant volume cooling
(ii) Change in internal energy during constant volume process
(iii) Net work done and heat transferred during the cycle. (4.5)

5. Air flows steadily at the rate of 0.4 kg / s through an air compressor entering at 6 m/s with a pressure of 1 bar and specific volume of 0.87 m^3 / kg and leaving at 5 m/s with a pressure of 7 bar and a specific volume of 0.16 m^3 / kg. The internal energy of the air leaving is 90 kJ / kg greater than that of the air entering. Heat absorbed by cooling water in a jacket surrounding the cylinder from the air is at the rate of 60 kJ / s. calculate the power required to drive the compressor. (3)

Part B

1. State the differences between the following materials on the basis of their composition, properties and applications.

(a) Grey cast iron and ductile cast iron

(b) High carbon steel and high speed steel (2.5×2)

2. "Patterns are not truly identical to the final cast products". Justify the statement suitably. 2.5

3. Writ short notes on the following

(a) Composites

(b) Brasses and bronzes (2.5×2)