

**Sylhet Engineering College, Sylhet**  
**(Shahjalal University of Science & Technology)**  
**Department of Civil Engineering**

**Final Examination, 2023**

**1<sup>st</sup> Year 2<sup>nd</sup> Semester**

**Course No.: MAT 0541 1203**

**Course Title: Differential Equation and Statistics**

**Time: 03 (Three) hours**

**Full Marks: 60**

N.B. : (i) Answer all questions from each PART

(ii) Use separate answer scripts for each PART

(iii) Marks allotted are indicated in the margin

(iv) Special Instruction (if any)-----N/A-----

**PART-A**

(Answer all questions)

- 1 (a) Define general solution and particular solution with example and graph. Obtain the differential equation whose one particular solution is  $y = e^x \cos 4x$ . 04
- (b) Solve: (i)  $\sin^{-1} \left( \frac{dy}{dx} \right) = x+y$  (ii)  $(3x^2y - 6x)dx + (x^3 + 2y)dy = 0$  (3+3) 06
- 2 (a) Which function is a trial solution of a linear differential equation and how many type solution of a auxiliary equation. Solve the following linear differential equation:  $(D^2 + 2D + 1)y = e^x + x^2$  05
- (b) Find particular solution of the differential equation  $(D^2 - 3D + 2)y = e^x$ , when  $y(0)=3$  and  $y'(0)=3$ . 05

**OR**

Solve: (a)  $\frac{d^2y}{dx^2} + y = \sin 2x$  (b)  $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = x^2 e^{2x}$  (3+4+3) 10  
 (c)  $(D^2 - 1)y = x^2 \sin x$

3. (a) Define Partial differential equation. Form a partial differential equation by eliminating arbitrary constants from the equation:  $(x - a)^2 + (y - b)^2 + z^2 = 4$  05
- (b) Form a partial differential equation by eliminating arbitrary function  $\phi$  from  $\phi(x + y - z, x^2 + y^2 + z^2) = 0$  05

**PART-B**

(Answer all questions)

4. (a) Construct a histogram and frequency polygon from the following data 03
- |           |       |       |       |       |       |       |
|-----------|-------|-------|-------|-------|-------|-------|
| Height    | 61-65 | 66-70 | 71-75 | 76-80 | 81-85 | 86-90 |
| Frequency | 3     | 3     | 8     | 10    | 5     | 1     |
- (b) Define Arithmetic mean and Geometric mean of a frequency distribution. Find Median and Mood from the following data 07
- |                    |      |       |       |       |        |
|--------------------|------|-------|-------|-------|--------|
| Marks              | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| Number of students | 5    | 20    | 35    | 7     | 3      |
5. (a) The joint probability function of x and y is  $P(x, y) = c(x + y)$ ;  $x=1, 2, 3$ ;  $y=1, 2$ . 06  
 Find i) the marginal probability function of x and y ii) Conditional probability function of x for given y and that of y for given x.
- (b) A bag contains 3 reds, 3 black, and 6 white identical balls. Three balls are drawn at random. What is the probability that all balls are of same color. 04
6. (a) Two cards are drawn from a well shuffled ordinary deck of 52 cards. Find the probability that they are both aces if the first card is (i)replaced (ii)not replaced 02
- (b) If 20% of the bolts produced by a machine are defective, determine the probability that, out of 4 bolts chosen at random, (a)1 ,(b)0 ,(c)at most 2 bolts will be defective. 03
- (c) Find the probability of boys and girls in families with three children, assuming equal probabilities for boys and girls. 05

**OR**

- (a) If 3 % of the electric bulbs manufactured by a company are defective, Using Poisson distribution find the probability that in a sample of 100 bulbs (a) 4 and (b) 5 bulbs are defective. 05
- (b) Following table shows the number of days, in a 50-days period during which X automobile accidents occurred in city. Fit a poisson distribution to the data. 05

Number of accidents (X)	0	1	2	3	4	
Number of Days (f)	21	18	7	3	1	=50

**Sylhet Engineering College, Sylhet**  
(Shahjalal University of Science & Technology)  
Department of Civil Engineering

Final Examination, 2023  
Course No.: PHY 0533 1201  
Time: 03 (Three) hours

1<sup>st</sup> Year 2<sup>nd</sup> Semester  
Course Title: Physics II  
Full Marks: 60

N.B. : (i) Answer all questions from each PART

(ii) Use separate answer scripts for each PART

(iii) Marks allotted are indicated in the margin

(iv) Special Instruction (if any)-----N/A-----

**PART- A**

(Answer all questions)

1. (a) Charge is quantized – explain. 2
- (b) If the flux of the E-field through a closed surface is zero then which of these following statements are correct? explain your answer. 4
  - i) The electric field must be zero everywhere on the surface.
  - ii) The electric field may be zero everywhere on the surface.
  - iii) The net charge inside the surface must be zero.
- (c) Find charge for these figure below: 4

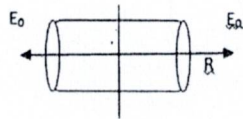


Fig:1

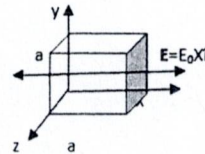


fig:2

**OR**

- (a) How electric field gives an idea about electric potential? 2
  - (b) In a spherical distribution, the charge density varies as  $\rho(r) = A/r$  for  $a < r < b$  where A is a constant. A point charge Q lies at the centre of the sphere at  $r=0$ . find the value of A for which the electric field in the region  $a < r < b$  is constant. 4
  - (c) How much work is required to move a  $-50\mu\text{C}$  charge from a electric potential of  $-50\text{v}$  to  $250\text{v}$  if the charge accelerated from rest. What is the final speed if it has a mass of  $0.01\text{gm}$ ? 4
2. (a) What is metallic bond? Write the properties of metallic bond. 3
  - (b) Define ionic bond? Explain ionic bond with example. 4
  - (c) Distinguish between crystalline solid and amorphous solid. 3
3. (a) What do you mean by plasticity and elasticity? 3
  - (b) Derive Bragg's law for X-ray diffraction in crystalline, 4
  - (c) Distinction between metal and semi-conductor. 3

**PART- B**

(Answer all questions)

4. (a) What is a dielectric material? For a given potential difference does a capacitor store more or less charge with a dielectric that it does without dielectric? 2
  - (b) A current of  $3.0\text{S}$  flows down a straight metal rod that has a  $0.20\text{cm}$  diameter. The rod is  $1.5\text{m}$  long and the potential difference between its ends is  $40\text{v}$ . Find: 5
    - I. Current density
    - II. Field in the rod
    - III. Resistivity of the material of the rod
  - (c) write down Maxwell's equation for electromagnetic induction. 3
5. (a) What is electric flux? 3
  - (b) State and explain Gauss's law for two-point charges having equal magnitude but opposite sign. 4.5
  - (c) What should be the distance of separation between the total positive and negative charges of the copper coin ( $1.345 \times 10^5\text{C}$ ) and their force of attraction of  $4.5\text{N}$ ? 2.5
6. (a) Define half life and work function. 3
  - (b) What is radioactive decay? Find out radioactive decay law. 3
  - (c) Explain Bohr's atomic model with figure. 4

**OR**

- (a) Write short note on photo-electric effect. 3
- (b) Explain Einstein's hypothesis of photo-electric effect. 3
- (c) State and explain Compton effect. 4

**Sylhet Engineering College, Sylhet**  
**1st year 2nd Semester Final Examination – 2023**  
**Department of Civil Engineering**  
**Course No: CE 0715 1231**  
**Course Title: Engineering Mechanics**

**Time: 3.00 Hours**

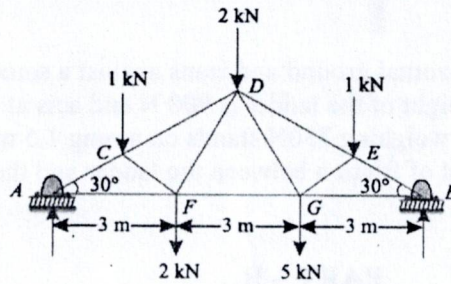
**Total Marks: 60**

[Answer all questions from each part]

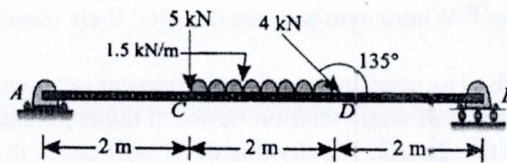
**PART – A**

Marks

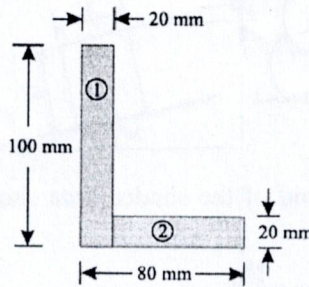
- 1.(a) A truss of 9 m span is loaded as shown in figure below. Find the reactions at the support A, B. 05



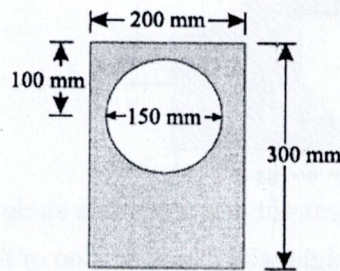
- (b) A beam AB of 6 m span is loaded as shown in figure below. Find the reactions at A,B. 05



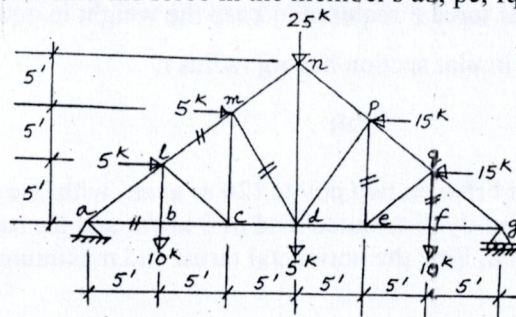
- 2.(a) Find the centroid of an unequal angle section 100 mm × 80 mm × 20 mm. 04



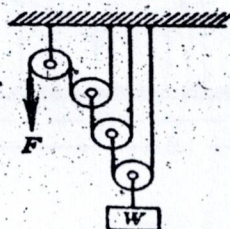
- (b) Find the moment of inertia of a hollow section shown in Figure below about an axis passing through its centre of gravity and parallel X-X axis. 06



- 3.(a) For the truss shown in Figure. find the force in the member's ab, pe, fq, dm and lm. 06

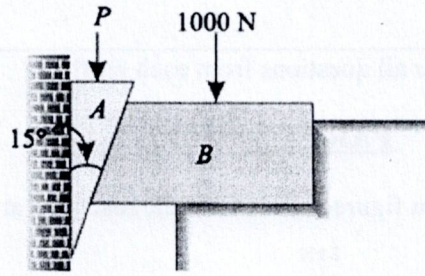


- (b) In the system of sheaves shown in figure. What force F will hold a weight of W= 800 lb. in equilibrium? There are no frictional losses at the axes. 04



OR

- (a) A  $15^\circ$  wedge (A) has to be driven for tightening a body (B) loaded with 1000N weight as shown in figure below. If the angle of friction for all the surfaces is  $14^\circ$ , find graphically the force (P), which should be applied to the wedge. 05



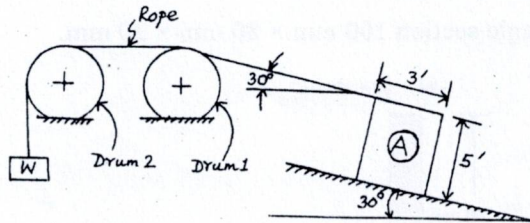
- (b) A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle  $70^\circ$  with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750N stands on a rung 1.5 metre from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor. 05

**PART - B**

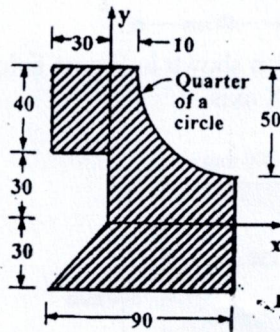
Marks

- 4.(a) Prove that for belt friction  $T_1 = T_2 e^{f\theta}$  Where symbols are denoted their usual meaning. 05

- (b) The body A in Figure, weighs 200 lb. The coefficient of static friction between the body A and the inclined plane is 0.4. The coefficient of static friction between the rope and the drum1 is 0.3 while it is 0.2 between the rope and the drum2. What value of W will cause motion of the body A to impend up the plane? 05



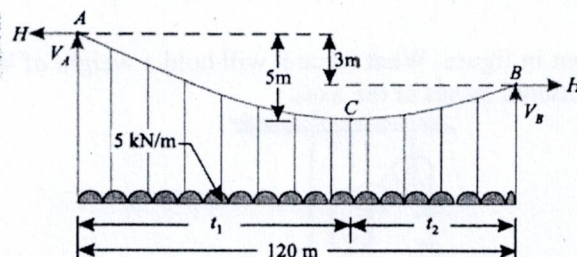
- 5.(a) Find the x and y coordinates of the centroid of the shaded area shown in Figure. all dimensions are in mm. 05



- (b) Derive an expression for determining the centroid of a sector of a circle of radius r. 05
- 6.(a) A pulley system is set up to lift a 900 lb weight with a combination of four movable pulleys and two fixed pulleys. The system has a total of eight supporting strands. If there is a 10% friction loss in the system, what is the actual force F required to keep the weight in equilibrium? 06
- (b) Determine moment of inertia of a circular section having radius r. 04

OR

- (a) A cable of uniform thickness hangs between two points 120 m apart, with one end 3 m above the other. The cable loaded with a uniformly distributed load of 5 kN/m and the sag of the cable, measured from the higher end, is 5 m. Find the horizontal thrust and maximum tension in the cable. 08



- (b) State Varignon's theorem. 02

**Sylhet Engineering College, Sylhet**  
**(Shahjalal University of Science & Technology)**

**Department of Civil Engineering**

**Final Examination, 2023**  
**Course No: CHE 0531 1203**  
**Time: 02 (Two) hours**

**1<sup>st</sup> Year 2<sup>nd</sup> Semester**  
**Course Title: Chemistry II**  
**Full Marks: 60**

---

N.B. : (i) Answer all the questions from each PART (ii) Use separate answer scripts for each PART  
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-----N/A-----

---

**PART-A**

(Answer all the questions)

1. (a) Derive the rate law expression for the reaction:  $2A \rightarrow \text{Products}$  3
- (b) Describe graphical and differential method of determining the order of a reaction. 4
- (c) How does temperature affect the rate of a reaction? Explain with the help of Arrhenius equation. 4
- (d) Define activation energy. The values of the rate constant (k) for the reaction:  $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$  were determined at several temperatures. A plot of  $\ln k$  versus  $1/T$  gave a straight line of which the slope was found to be  $-1.2 \times 10^4 \text{ K}$ . What is the activation energy of the reaction? 1+3
2. (a) Distinguish among multimolecular, macromolecular and associated colloids. 4
- (b) Discuss two chemical methods of preparing sols. Explain optical and electrical properties of colloids. 2+4
- (c) What are the factors that affect the rate of corrosion? Prove that rusting of iron follows electrochemical theory. 1+4
- Or, (a) Define colloid. Differentiate between lyophilic and lyophobic sols. 1+3
- (b) Write informative note on Electro-dialysis and Brødig's Arc method. Mention some applications of colloids. 4+2
- (c) What are corrosion inhibitors? Discuss different types of corrosion inhibitors. 1+4

**PART-B**

(Answer all the questions)

3. (a) What do you mean by DO, BOD and COD? 3
- (b) What is environmental chemistry? What are the techniques used to purify industrial waste water? 5
- (c) Write down the effects of toxic elements. 3
- (d) What is water pollution? How are water pollutant classified? Give suitable example. 4
4. (a) Write down the basic criteria that monomers generally fulfill to produce high weight polymers. Distinguish between addition and condensation polymerization. 2+3
- (b) Explain the tacticity of polymer with proper example. Write the preparation and uses of the following polymers: PVC and Nylon-6,6. 3+3
- (c) What are the functions of pigments in paint? Write down the constituents of paint and varnish. 1+3
- Or, (a) Define monomer. Classify the polymers on the basis of origin and molecular forces. 1+4
- (b) What do you mean by degree of polymerization and polymer degradation? Differentiate between LDPE and HDPE. 2+3
- (c) Define paint. What are the requirements of a good paint and varnish? 1+4

**Sylhet Engineering College, Sylhet**  
 (Shahjalal University of Science & Technology)  
 Department of Electrical & Electronic Engineering

Final Examination, 2023  
 Course No: EEE 07131211

1<sup>st</sup> year 2<sup>nd</sup> Semester  
 Course Title: Basic Electrical Technology

Time: 02 (Two) hours

Full Marks: 60

N.B. : (i) Answer all questions from each PART (ii) Use separate answer scripts for each PART  
 (iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-----N/A-----

**PART-A**

1. (a) What is the difference between Super Mesh & Mesh? 03
- (b) Using nodal analysis, find  $v_o$  in the circuit Fig. 1(a). 06

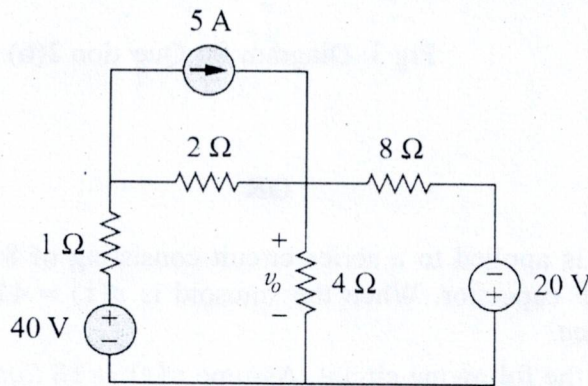


Fig. 1(a)

- (c) Find  $i_o$  in the circuit in Fig. 2(b) using the superposition theorem. 06

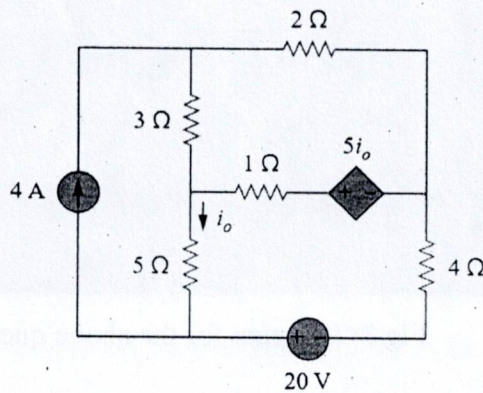


Fig. 1(b)

2. (a) Find the total impedance (in **polar** form) of an R-L-C series circuit where  $R=20\Omega$ ,  $L=5\text{mH}$  and  $C=156.8\mu\text{F}$ . Assume the source is  $v(t) = 400 \text{Sin}(314t + 12^\circ)\text{Volt}$ . 05
- (b) Compute  $V_1$  and  $V_2$  in the following circuit. You must draw all the necessary diagrams. 08

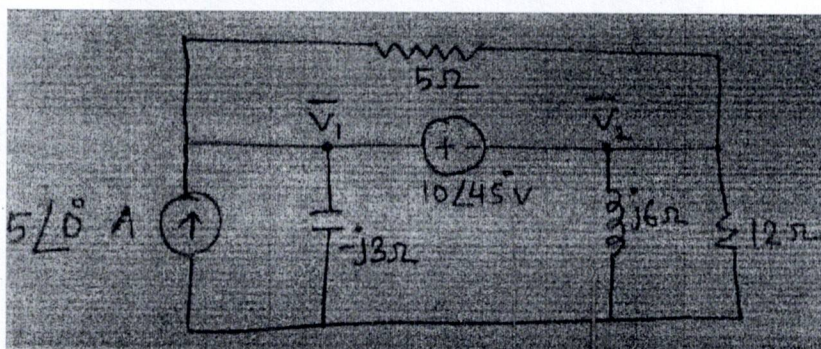


Fig 2: Diagram for Question 2(a)

- (c) Using source transformation, determine the equivalent circuit where the source is a **current** source. **Do not change** the unknown load  $Z_L$ . Circuit is given below. 02

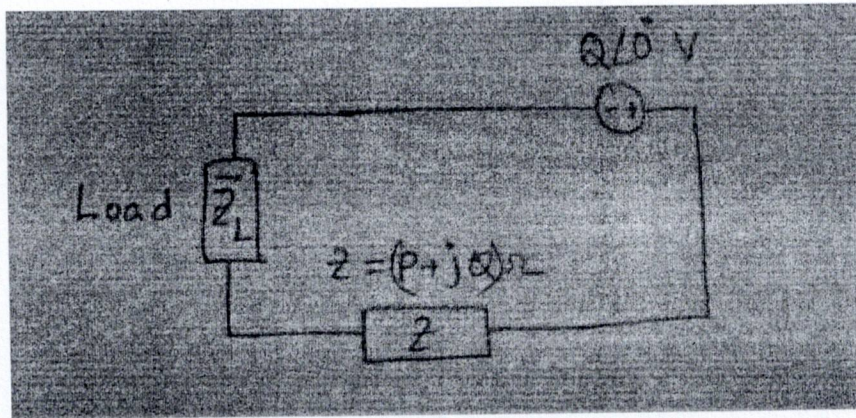


Fig 3: Diagram for Question 2(b)

OR

2. (a) A sinusoidal voltage is applied to a series circuit consisting of 8 ohms resistor, 0.0531 H inductor, and 189.7  $\mu$ F capacitor. When the sinusoid is  $v(t) = 410 \cos(314t + 15^\circ)$  Volt, calculate the impedance. 05
- (b) Find  $V_1$  and  $V_2$  from the following circuit. Assume  $v(t) = 15 \cos(314t + 15^\circ)$  Volt as the voltage source between the two nodes. You must draw all the necessary diagrams. 08

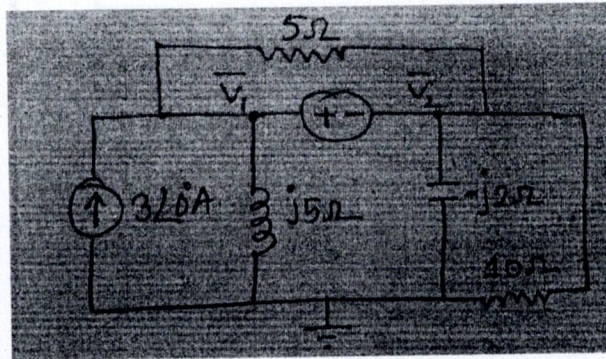


Fig 3: Diagram for the above question

- (c) Using source transformation, determine the equivalent circuit where the source is a **voltage** source. **Do not change** the unknown load  $Z_L$ . Circuit is given below. 02

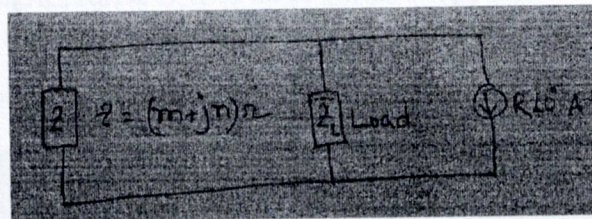


Fig 4: Diagram for the above question

# Sylhet Engineering College

Department of Civil Engineering

BSc. Program (1/2) Session: 2022-23

Course Code: HUM 0311 1205; Course Title: Economics

Semester Final Examination

Total Marks: 60

Time: 02 Hours

[Answer All the questions from each part. Figures in the margin indicate full marks. All the parts of a question must be answered chronologically.]

## Part-"A"

01. (a) 'Economics is a science of choice' – explain. 03  
(b) What do you understand by Micro Economics? 03  
(c) What do you mean by positive and normative economics? 03  
(d) Define an economy. 02  
(e) What specific problem of an economy is studied in welfare economics? 04
02. (a) What do you mean by an economic problem? 02  
(b) How does an economic problem arise? 03  
(c) "An economy always produces on, but not inside, a PPC." Give reasons. 03  
(d) Name the factors that lead to the shift of the PPC? 03  
(e) Distinguish between capital-intensive and labor-intensive technique of production. 04
- OR. (a) Define demand. What is demand schedule? 03  
(b) Explain law of demand. Illustrate your answer with appropriate diagram. 03  
(c) What factors influence the demand for a commodity or what factors determine demand? 03  
(d) Why does demand curve slope downwards from left to right? 03  
(e) What are the important exceptions to the law of demand? 03

## Part-"B"

03. (a) What is meant by market in economics? 02  
(b) What is perfect competition? State its main features. 04  
(c) Distinguish between perfect competition and monopoly. 03  
(d) How does oligopoly differ from monopolistic competition? 03  
(e) "Under perfect competition, the seller is a price-taker; under monopoly, he is the price-maker." Explain. 03
04. (a) Distinguish between Gross Domestic Product at market prices and Net National Product at factor cost. 02  
(b) What are transfer payments? How are they treated in the estimation of national income? 03  
(c) What precautions are necessary while estimating national income by income method? 03  
(d) What is GNP deflator? Give reasons for not including leisure in GNP. Does GNP measure national welfare? 04  
(e) Define a central bank. What are the main functions of the central bank of a country? 03
- OR. (a) Define fractional reserve banking and secondary reserves. 02  
(b) How do banks earn profit? Explain briefly. 03  
(c) Why do banks seek to have diversified portfolio of assets? 03  
(d) How does a decrease in bank reserves lead to a decrease in the money stock? 04  
(e) Why might banks choose to hold some of their assets in the form of excess reserves? 03

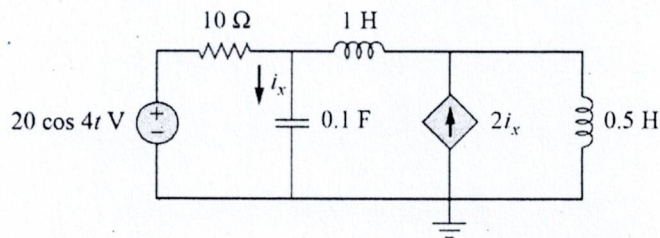
✓

**PART-B**

3. (a) Write short notes on “Rotor & Stator” of an induction motor. 03
- (b) Derive the EMF equation for a single phase transformer. 04
- (c) Explain (with necessary diagrams) **three** main features of **practical** transformer in details. 08
4. (a) Calculate the phase angle between  $v_1 = -50\sin(\omega t + 50^\circ)V$  &  $v_2 = 50\cos(\omega t - 10^\circ)V$ . Which one is **leading**? 2+1
- (b) Define circuit breaker. What are the four main characteristics of a circuit breaker? 1+2
- (c) A single phase transformer has a maximum magnetic flux of 0.0315 Wb in the core. It is energized by a 50 Hz supply. If the number of turns in primary winding is 472, calculate EMF at the primary winding. 05
- (d) Draw vector diagram of a balanced three phase supply showing **positive** sequence. 02
- (e) In a wye-connected load, what will be the relationship between phase voltage and line voltage? If each load receives 2.98 Ampere, what will be the line current? 1+1

**OR**

4. (a) A three phase circuit has the following node equation: 03
- $$\frac{dv}{dt} + 50v + 500 \int_{-\infty}^t v dt = 50 \cos(377t - 10^\circ)V$$
- Determine  $v(t)$  using **phasor** approach.
- (b) Define Fuse. Write down **two** advantages and **two** disadvantages of Fuse. 1+1+1
- (c) Find  $i_x$  in the circuit of Fig. shown below. 05



- (d) Draw vector diagram of a balanced three phase supply showing **negative** sequence. 02
- (e) In a delta-connected load, what will be the relationship between phase current and line current? If the voltage across each load is 230 V, what will be the line voltage? 1+1