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

Final Examination, 2024 — **1st Year 2nd Semester**

Course No.: MATH 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

1. **(a)** Obtain the differential equation whose one particular solution is $y = e^x \sin 5x$. **3+3+4**
   (b) Solve: $3e^x \tan y\,dx+(1-e^x)\sec^2 y\,dy = 0$
   (c) Solve: $y^2 + x^2\frac{dy}{dx} = xy\frac{dy}{dx}$

2. **(a)** Solve: $(x^3 + 3xy^2)dx+(3x^2y+y^3)dy = 0$ **3**
   (b) Solve: $\frac{dy}{dx}+\frac{1}{x}\sin 2y = x^3\cos^2 y$ **4**
   (c) Find the particular solution of $\frac{d^2s}{dt^2}+8\frac{ds}{dt}+25s = 0$ when $s(0) = 4$ and $s'(0) = -16$ **3**

3. **Solve : (a)** $(D^2 + 2D + 1)y = 2x+x^2$ **3+3+4**
   (b) $(D^2 + 4)y = \sin 2x \sin x$
   (c) Solve : $(D^2 - 3D + 2)y = e^x$ When $y(0) = 3, y'(0) = 3$.

   OR

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

PART- B

4. **(a)** The height of the 100 male students at XYZ University is given below. Find 10 **10**

Height	60-62	63-65	66-68	69-71	72-74
Frequency(f)	5	18	42	27	8

(a)Mean deviation (b) Standard deviation (c) Variance (d) First quartile and third quartile.

5. **(a)** Find the probability of boys and girls in families with three children, assuming equal probabilities for boys and girls. **05**

   (b) Find out the skewness and kurtosis from the following frequency distribution. **05**

Class interval	11-15	16-20	21-25	26-30	31-35	36-40	41-45
Frequency	2	6	7	4	5	6	3

6. **(a)** Form a partial differential equation of $z = x^n f(\frac{x}{y})$ **03**
   (b) Form a partial differential equation of $\emptyset(x^2 + y^2, z-xy) = 0$ **03**
   (c) Solve: $x^2(y-z)p+y^2(z-x)q = z^2(x-y)$ **04**

   OR

   (a) Solve the partial differential equation : $xy^2p-y^3q+axz = 0$ **05**
   (b) Apply Charpit's method to find a complete integral of the partial differential equation $(p^2 + q^2)x = pz$. **05**

Sylhet Engineering College

Department of Civil Engineering

BSc. Program (1/2) Session: 2023-24

Course Code: HUM 0311 1205; Course Title: Economics

Semester Final Examination 2024

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)** Explain how scarcity forces individuals and societies to make choices, using a real-life example. **03**

(b) Differentiate between microeconomics and macroeconomics with suitable examples from the Bangladesh economy. **06**

(c) Apply the circular flow model to explain the relationship between households and firms. **06**

02. **(a)** **Explain** the law of demand and **illustrate** it with a suitable diagram. **03**

(b) What is market equilibrium? **03**

(c) What is price elasticity of demand of given table? Answer with each type. **09**

Price	**Quantity demand**
10	50
8	70

OR.

(a) **Distinguish** between a change in demand and a change in quantity demanded using examples. **04**

(b) Illustrate how a Production Possibility Curve (PPC) explains efficiency and inefficiency. **11**

Part-"B"

03. **(a)** What is meant by production in economics and the factors of production? **06**

(b) Describe the law of diminishing returns. **05**

(c) What is market structure? What are the main features of market structure? **04**

04. **(a)** "Under perfect competition, the seller is a price-taker; under monopoly, he is the price-maker."-Explain. **04**

(b) Describe the advantages and disadvantages of pure competition market. **05**

(c) Distinguish between monopolistic and oligopoly. **06**

OR.

(a) **Write the short notes: (any two)** ~~3*3~~ 2×4

i. Opportunity cost, Fixed Cost, marginal cost.
ii. Describe the perfectly competitive market.
iii. Monopolistic competition (with example).

(b) Analyze the relationship between average cost and marginal cost curves. ~~06~~ 07

Sylhet Engineering College, Sylhet
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Department of Civil Engineering

Final Examination, 2024 — **1st Year 2nd Semester**
Course No: CHE 0531 1203 — **Course Title: Chemistry II**
Time: 02 (Two) Hours — **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

1.	(a)	Define pseudo unimolecular reaction with example.	2
	(b)	What do you mean by half-life of a reaction? Prove that half-life period of a first order reaction is independent of its initial concentration.	2+5
	(c)	At 25^0c half-life of the reduction reaction of N_2O_5 is 3400 minutes. Find out- i. The relative rate constant of the reaction; ii. Time that will be required for completion of 99% of the reaction.	3+3
2.	(a)	What is coagulation? Arrange and explain the order of precipitation power of As^{+3}, Ba^{+2} and Na^{+} ions for the precipitation of As_2S_3 sol with reasons.	1+3
	(b)	Describe electro-dialysis and ultra-filtration for the purification of colloids.	7
	(c)	Define gold number. Gold numbers of some lyophillic colloids such as gelatin, sodium oleate and hemoglobin are 0.005-0.01, 0.4-1.0 and 0.03-0.07 respectively. Arrange them in increasing order of their protective power logically.	1+3
Or,	(a)	Distinguish between corrosion and erosion.	4
	(b)	Define corrosion. What is the purpose of using corrosion inhibitors and how do they function chemically.	6
	(c)	What are corrosion inhibitors? Discuss different types of corrosion inhibitors.	1+4

PART-B

3.	(a)	Define pollutant and contaminant. List the harmful impact of As and Pb in human body.	2+4
	(b)	Interpret quality parameters of industrial waste water and standards for drinking water.	5
	(c)	What is threshold odor number (TON)? The threshold odor number for a water sample of 40 ml, diluted to standard 200 ml mixture, in which odor is just barely detectable to the sense of smell?	1+3
4.	(a)	What do you mean by degree of polymerization, polymer degradation and vulcanization of rubber?	6
	(b)	Differentiate between thermoplastic and thermosetting polymer.	4
	(c)	Write the preparation and uses of the following polymers: PVC and Nylon-6,6	5
Or,	(a)	What is paint? Write down the application of paint.	3
	(b)	What are the functions of pigments in paints? Mention the important characteristics of a good varnish.	3+3
	(c)	Define activation energy. How does temperature affect the rate of a reaction? Explain with the help of Arrhenius equation.	1+5

Sylhet Engineering College, Sylhet
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Department of Civil Engineering

Final Examination, 2024 | **1st year 2nd Semester**
Course No: PHY 0533 1201 | **Course Title: Physics II**
Time: 03 (Three) hours | **Full Marks: 60**

N.B. : (i) Answer all question 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)	Distinguish between metallic bond and ionic bond.	03
	(b)	What are solids? Explain the classification of solids with example.	04
	(c)	What is polymer? Write the advantages of polymer.	03
2.	(a)	What is radioactive decay? Obtain radioactive decay law.	03
	(b)	Derive Bragg's law for X-ray diffraction in crystalline.	04
	(c)	Distinction between metal and semi-conductor.	03
3.	(a)	Explain the term electric field and electric flux?	03
	(b)	What is electric dipole? Calculate the electric field intensity due to an electric dipole at a point on the perpendicular bisector of the dipole.	04
	(c)	The distance r between electron and proton in the hydrogen atom is about $5.3 \times 10^{-11}\ m$. What are the magnitude of electrical force and gravitational force between the two particles?	03

or

3.	(a)	Discuss binding energy curve diagram.	03
	(b)	From which nuclear reaction you will get greater energy? Explain your answer.	04
	(c)	How much energy will be released for the following nuclear reaction? $_3Li^7 + {}_1H^1 = {}_2He^4 + {}_2He^4$	03

PART-B

4.	(a)	What is magnetic field? State the Biot-Sevart law.	03
	(b)	A charged particle is projected into a magnetic field in a direction perpendicular to the field. Obtain expression for (i) the radius of circular path and (ii) the period for one revolution.	4.5
	(c)	Electrons enter a uniform magnetic field at right angles to the field. What is the magnitude of the field for electrons which traverse a complete cycle in $10^{-9}s$.	2.5
5.	(a)	Differentiate between current and current density?	03
	(b)	State and explain Gauss's law for two point charges having equal magnitude but opposite sign.	04
	(c)	Two capacitors have a capacity of 5 μF when connected in parallel and 1.2 μF when connected series. Calculate their individual capacitances.	03
6.	(a)	Write the postulates of special theory of relativity.	03
	b)	From Lorentz space time transformation formula, obtain the expression of length contraction and time dilation.	04
	c)	The length of a spaceship is measured to be exactly half its actual length. Calculate (i) the Speed of the spaceship and (ii) the time dilation corresponding to one second on the spaceship.	03

or

	a)	Write the differences between nuclear fission and nuclear fusion.	03
	b)	What were the experimental observations of the photoelectric effect? Explain with figure.	04
	c)	Explain Bohr's atomic model with limitations.	03

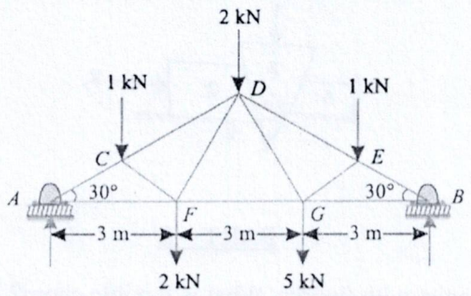
Sylhet Engineering College, Sylhet
1st year 2nd Semester Final Examination – 2024
Department of Civil Engineering
Course No: CE 0715 1231
Course Title: Engineering Mechanics

Time: 3.00 Hours **Total Marks: 60**

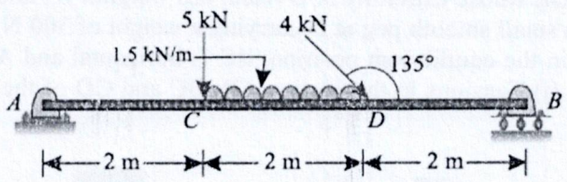
[Answer all questions from each part]

PART – A

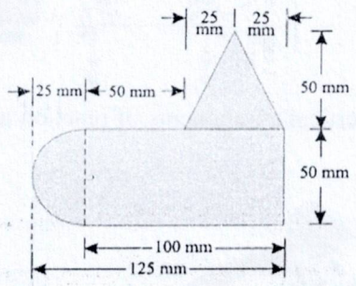
1.(a) A truss of 9 m span is loaded as shown in figure below. Find the reactions at the support A, B. **06**



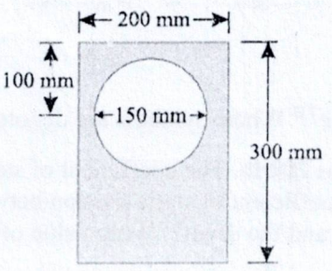
(b) A beam AB of 6 m span is loaded as shown in figure below. Find the reactions at A,B. **04**



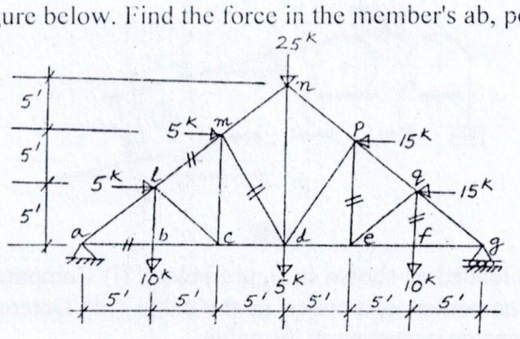
2.(a) A uniform lamina shown in figure below consists of a rectangle, a circle and a triangle. Determine the centre of gravity of the lamina. [All dimensions are in mm.] **05**



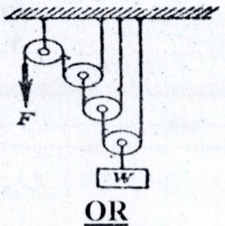
(b) Find the moment of inertia of a hollow section shown in Figure below about an axis passing through its centre of gravity and parallel X-X axis. **05**



3.(a) For the truss shown in figure below. Find the force in the member's ab, pe, fq, dm and lm. **06**



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



OR

(a) Calculate the member forces of members BC and FE of the truss shown in the figure below. By any method. **05**

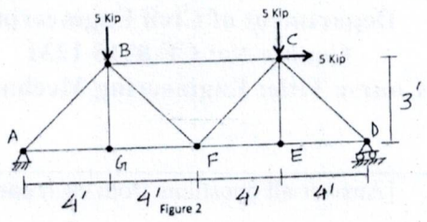
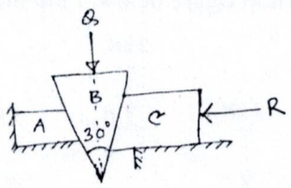


Figure 2

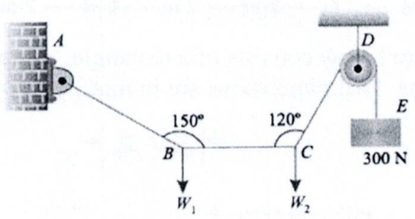
(b) In below figure, let W_A= 2000 lb, W_B= 500 lb, Wc = 5000 lb, and force R= 8000 lb. Neglecting all friction so that the reactions are normal to the surfaces, find the force Q on top of the wedge. **05**



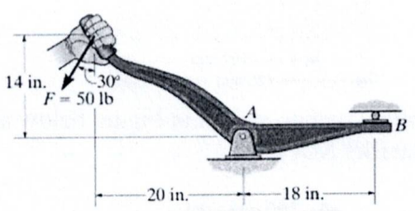
PART – B

4.(a) State Lami's theorem & depict with figures. What is flexible chord? Mention two uses of it. **04**

(b) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in figure below. If in the equilibrium position, BC is horizontal and AB and CD make 150° and 120° with BC, find (i) Tensions in the portion AB, BC and CD of the string and (ii) Magnitudes of W_1 and W_2. **06**



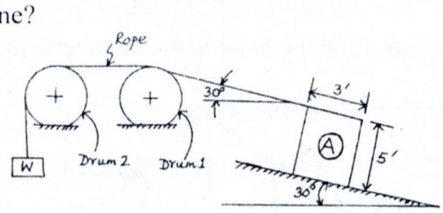
5.(a) Determine the horizontal and vertical components of reaction at the pin at A and the reaction of the roller at B on the lever. **08**



(b) Define limiting Frictional force. **02**

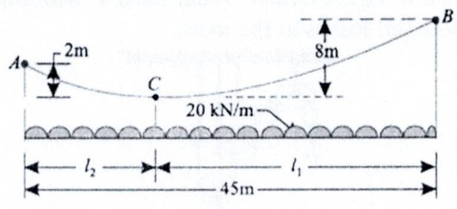
6.(a) Prove that for belt friction $T_1 = T_2 e^{f\emptyset}$ Where symbols are denoted their usual meaning. **05**

(b) The body A in Figure below, 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**



OR

(a) A Cable is suspended and loaded as shown in figure below. (i) Compute the length of the cable (ii) Compute horizontal component of tension in the cable (iii) Determine the magnitude and position of the maximum tension occurring in the cable. **08**



(b) State Varignon's theorem. **02**

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Final Examination, 2024 — **1st year 2nd Semester**

Course No: EEE 07131211 — **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

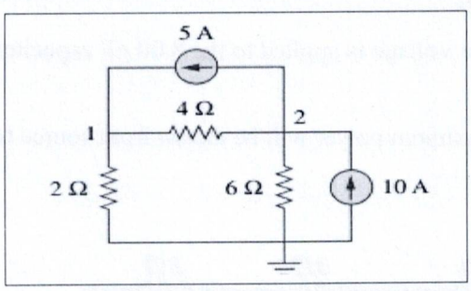
(iii) Marks allotted are indicated in the margin(iv) Special Instruction (if any)----------N/A----------

PART-A

1. (a) What is self-inductance and mutual inductance? 02

(b) Prove that the energy stored in an inductor is $0.5Li^2$. 05

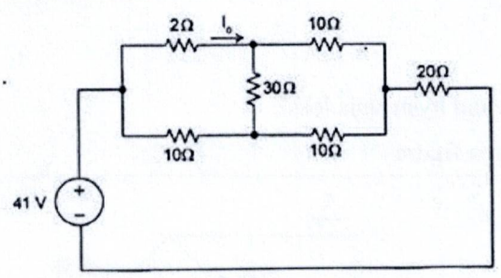
(c) Calculate the node voltages in the circuit shown in the following figure. 08



2. (a) What is Wye-Delta transformation? Why is it necessary? 02

(b) A balanced Delta network has a resistor of 90 Ω in each branch. Calculate the value of each resistor in the equivalent balanced Wye network. 05

(c) Solve with the help of wye-delta conversion. 08

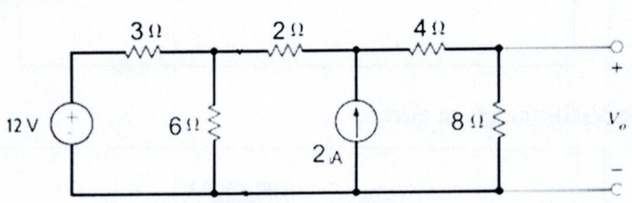


OR

(a) Describe Thevenin and Norton's Theorem. 02

(b) Construct a circuit for Thevenin equivalent circuit between terminals a and b for the following 2-terminal network. The network involves single voltage sources (5 V) and four resistors (10 Ω, 8 Ω, 5 Ω, 5 Ω) connected in series. Calculate V-Th and R-Th. 05

(c) Find V_o using Thevenin Theorem 08

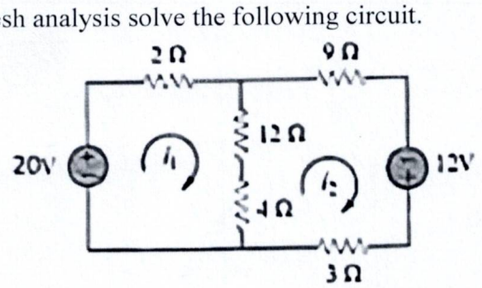


PART-B

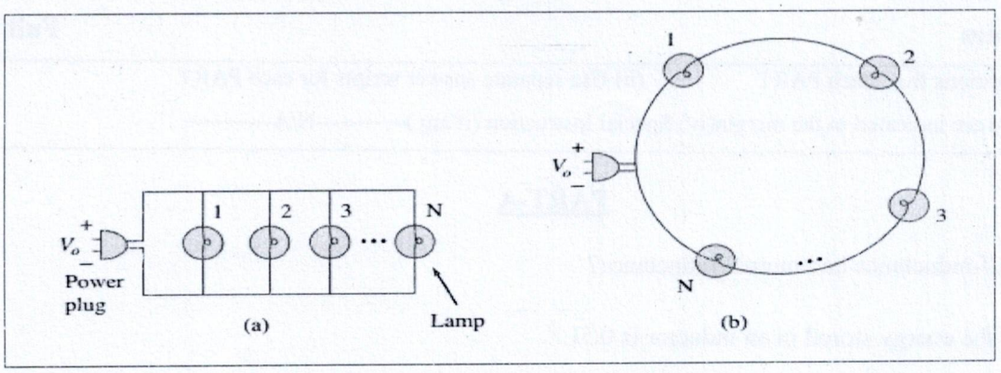
3. (a) Define Resistance, Branch, Node and Loop. **02**

(b) Explain Faraday's law of electromagnetic induction and Lenz's law. **02**

(c) What is reference node? Using Mesh analysis solve the following circuit. **04**



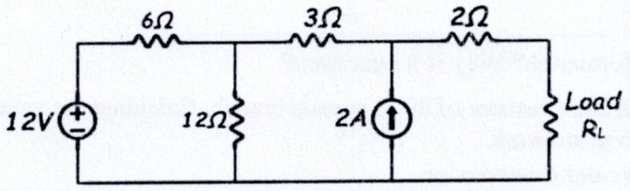
(d) There are 10 light bulbs that can be connected in parallel and 10 light bulbs that can be connected in series, each with a power rating of 40 W. If the voltage at the plug is 110 V for the parallel and series connections, calculate the current through each bulb for both cases. 07



4. (a) Define active and passive elements. 02

(b) What is magnetic induction? What voltage is applied to the 8.00 μF capacitor of a machine that stores 40.0 J of energy? 05

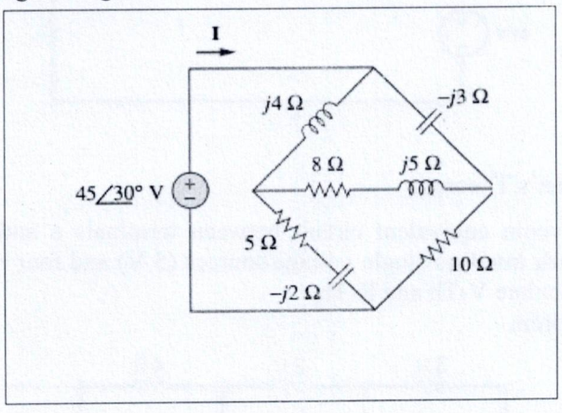
(c) Find the value of R_L for which maximum power will be drawn from source to load in the following circuit. 08



OR

(a) What is eddy current loss and hysteresis loss? 03

(b) Find **I** in the circuit of given figure- 06



(c) Determine $\mathbf{V_1}$ and $\mathbf{V_2}$ for the given circuit- 06