Bangladesh Army University of Science and Technology
Department of Civil Engineering

Final (Online Live) Examination, Winter 2021
Course Code: CE 1211
Time: 01 (One) hour

Level-1   Term-II
Course Title: Engineering Mechanics
Full Marks: 60

NB:
- Answer two questions including the compulsory question no.1 from this PART A.
- Figures in the margin indicate full marks allotted to each question.
- Symbols and abbreviations bear their standard meaning.
- The corresponding course outcomes (COs) are given in the right most column.

PART-A

Marks   COs

1. a) Find the resultant force and its direction for the forces acting on the rigid body as shown in Fig. 1.   (10)   1
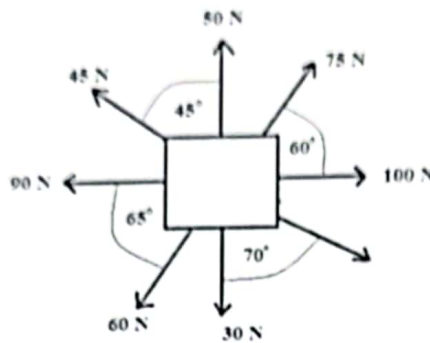

Fig. 1

b) Calculate member forces of the members 1, 3, 5 and 8 of the truss shown in the Fig. 2.   (20)   2
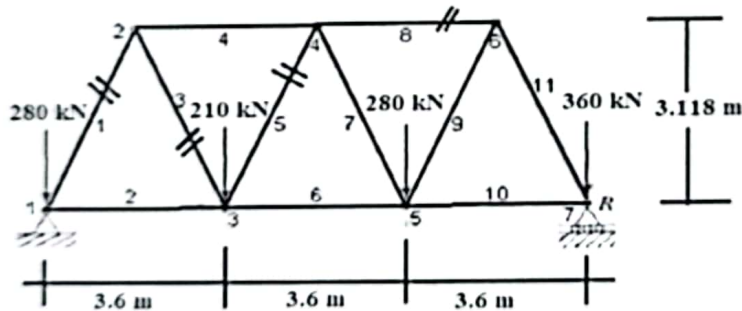

Fig. 2

2. a) Calculate the reactions at the supports A and B for the simply supported beam and the loading arrangement shown in the Fig. 3.   (15)   1
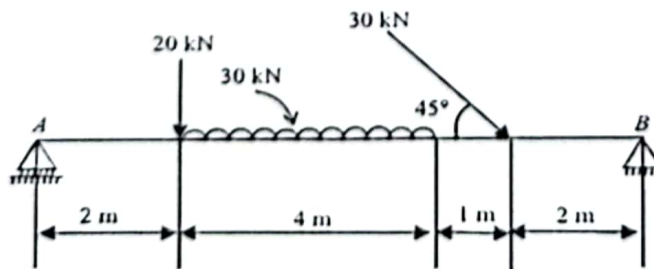

Fig. 3

CamScanner

b) In Fig. 4, the bodies A and B connected by a chord and resting on a smooth planes weight $W_A = 50$ lb and $W_B = 40$ lb. Find the tension in the chord and reactions in the contact surfaces. Given $\theta = 40°$. (15)
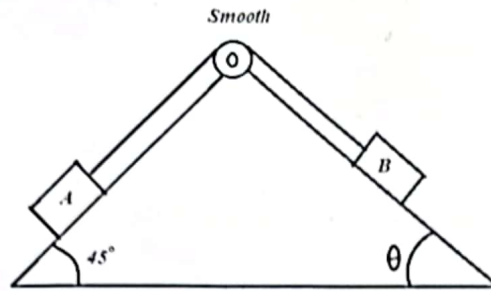

Fig. 4

3. a) A 5000 lb. sphere rests on a smooth plane inclined at an angle $\theta = 35°$ with the horizontal and against a smooth vertical wall as shown in Fig. 5 below. Find the reactions at the contact surfaces A and B. (15)

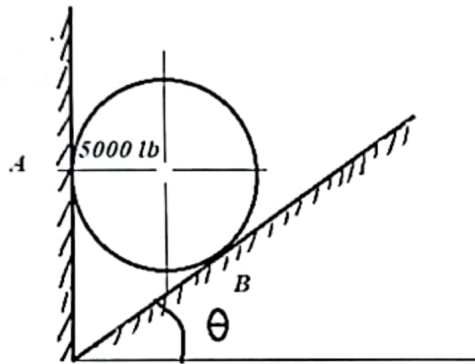Fig. 5

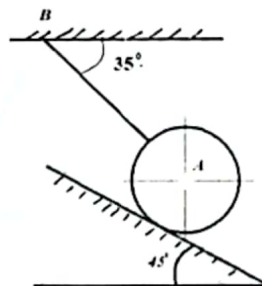b) Find the unknown forces in Fig. 6. Weight of the ball is given 300 lbs. (15)

Fig. 6

Bangladesh Army University of Science and Technology
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Course Code: CE 1211   **Course Title: Engineering Mechanics**
Time: 01 (One) hour   **Full Marks: 60**

NB:
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PART-B

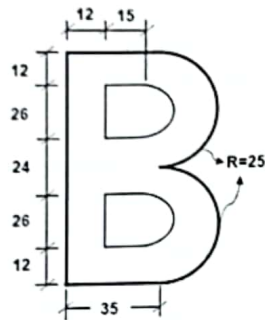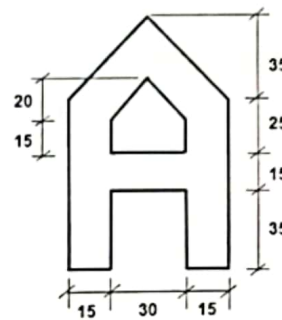|			Marks	COs
1.	a)	Explain the relations between moment of inertia and centroid for a composite section.	(05)	4
	b)	Locate the centroid of either of the two sections given in Fig. 1 and Fig. 2 below:	(25)	3

Fig. 1 (Dimensions in mm)   Fig. 2 (Dimensions in mm)

			Marks	COs
2.	a)	Explain the terms 'first moment of area' and 'second moment of area'.	(05)	4
	b)	Two sections are given in Fig. 3 and Fig. 4 below. Determine the moment of inertia of either of these two sections with respect to an axis at its base (Dimensions are in mm).	(25)	4
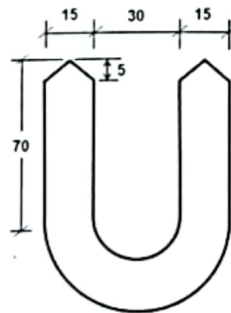
Fig. 3   Fig. 4
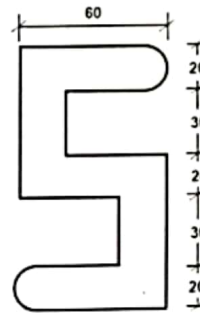
			Marks	COs
3.	a)	State the work-energy theorem.	(05)	1
	b)	A body A weighing $W_A = 20$ kg is on a plane as shown in Fig. 5. The coefficient of friction for this plane is $f_A = 0.3$. Two cables are attached to A through frictionless pulleys as shown. From the other end of a cable is suspended a body B weighing $W_B = 40$ kg.	(25)	1

Determine the tension in the cable and the speed of the body after they have moved 4 m from rest. The weight of the cable is negligible.

Fig. 5

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Final (Online Live) Examination, Winter 2021   Level-1   Term-II
Course Code: PHY 1209   Course Title: Physics II
Time: 01 (One) hour   Full Marks: 60

NB:
- Answer two questions including the compulsory question no.1 from this PART A.
- Figures in the margin indicate full marks allotted to each question.
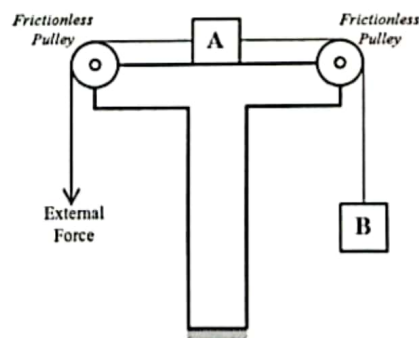- Symbols and abbreviations bear their standard meaning.
- The corresponding course outcomes (COs) are given in the right most column.
- Special instructions (if any): N/A

PART-A

			Marks	COs
1.	a)	What do you mean by electric lines of force?	05	1
	b)	Derive the expression of electric field at a point on the axis of a charged circular turn of wire.	15	2
	c)	Two charges $q_1 = 1.0 \times 10^{-6}C$ and $q_2 = 2.0 \times 10^{-6}C$ are kept 10 cm away from each other. At what point the line joining between two charges is the electric field strength zero?	10	3
2.	a)	Discuss the formation of Newton's rings by reflected light and calculate the radius of the nth dark ring. Why the centre of Newton's rings is dark?	22	2
	b)	Newton's rings are formed with sodium light between a plane glass plate and a convex lens surface. The diameters of two successive dark rings are 2.0 mm and 2.236 mm. What is the radius of curvature of the lens surface?	08	3
3.	a)	Define self-inductance and mutual inductance.	06	1
	b)	Derive the expression of self-inductance for a toroidal coil of circular cross-section.	14	2
	c)	An air core toroidal coil has 500 turns and a mean diameter 32 cm with a cross-sectional area of 2 cm^2. Calculate: i) the inductance of the coil and ii) the average emf induced when a current of 2 amp is reversed in a time of 0.02 sec.	10	3

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Final (Online Live) Examination, Winter 2021   Level-1   Term-II
Course Code: PHY 1209   Course Title: Physics II
Time: 01 (One) hour   Full Marks: 60

NB: • Answer two questions including the compulsory question no.4 from this PART B.
      • Figures in the margin indicate full marks allotted to each question.
      • Symbols and abbreviations bear their standard meaning.
      • The corresponding course outcomes (COs) are given in the right most column.
      • Special instructions (if any): N/A

PART-B

			Marks	Cos
4.	a)	What is length contraction?	05	1
	b)	Prove that the length of a stationary object with respect to an observer in motion is shorter than the length measured by the observer at rest.	15	2
	c)	What is the length of a meter stick moving parallel to its length when its mass is 3/2 of its rest mass?	10	3
5.	a)	Describe the Fraunhoffer diffraction pattern due to double slit. Prove that angular separation is inversely proportional to the distance between two slits.	22	2
	b)	Two polarizing sheets have their polarizing direction parallel so that the intensityon the transmitted light is maximum. Through what angle must either sheet be turned if the intensity is dropped by one-half?	08	3
6.	a)	Define nuclear fission and nuclear fusion reactions.	06	1
	b)	Derive an expression for the mean life of a radioactive atom.	16	2
	c)	Calculate the activity of 1.00 mg of Radon.	08	3

Bangladesh Army University of Science and Technology
Department of Civil Engineering

Final (Online Live) Examination, Winter 2021   Level-1   Term-II
Course Code: MATH 1209   Course Title: Math II (Ordinary & Partial Differential Equations and Matrices)

Time: 01 (One) hour   Full Marks: 60

NB:
- Answer two questions including the compulsory question no.1 from this PART A.
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- Special instructions (if any).

PART-A

			Marks	COs
1.	a)	Define Ordinary Differential Equations. Find the differential equation of all circles passing through the origin and having their centre on the $x-$axis.	12	1,3
	b)	Solve $2xy\frac{dy}{dx} - y^2 = x^2$.	13	2
	c)	Solve $(D^4 + 4)y = 0$.	5	2
2.	a)	Identify and solve this equation $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = y^2$.	15	2
	b)	Define nilpotent matrix. Show $A = \begin{bmatrix} 1 & -3 & -4 \\ -1 & 3 & 4 \\ 1 & -3 & -4 \end{bmatrix}$ is a nilpotent matrix.	15	4
3.	a)	Solve the following system of linear equations: $\begin{aligned} x + y + 2z &= 4 \\ 2x - y + 3z &= 9 \\ 3x - y - z &= 2. \end{aligned}$	15	4
	b)	Solve $y'' - 6y' + 9y = 6x^2 + 2 - 12e^{3x}$.	15	2

Bangladesh Army University of Science and Technology
Department of Civil Engineering

Final (Online Live) Examination, Winter 2021   Level-1   Term-II
Course Code: MATH 1209   Course Title: Math II (Ordinary & Partial Differential Equations and Matrices)

Time: 01 (One) hour   Full Marks: 60

NB:
- Answer two questions including the compulsory question no.4 from this PART B.
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- The corresponding course outcomes (COs) are given in the right most column.
- Special instructions (if any).

PART-B

			Marks	COs
4.	a)	Define partial differential equations. Form a PDE by eliminating arbitrary constant from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.	12	1
	b)	Solve $x(y-z)p + y(z-x)q = z(x-y)$.	13	2
	c)	Solve $r - 4s + 4t = 0$.	5	2
5.	a)	Solve $D^2 + 3DD' + 2D'^2 = 2x + 3y$.	12	2
	b)	Define compatible equations. Show that the equations $xp = yq$ and $z(xp + yq) = 2xy$ are compatible and solve them.	18	1,2
6.	a)	Solve $p^2 + q^2 = m^2$.	15	2
	b)	Define commute matrix. Show that $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 0 \\ -1 & -1 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & -1 & -6 \\ 3 & 2 & 9 \\ -1 & -1 & -4 \end{bmatrix}$ are commute matrix.	15	4

Bangladesh Army University of Science and Technology
Department of Civil Engineering

Final (Online Live) Examination, Winter 2021   Level-1   Term-II
Course Code: HUM 1209   Course Title: Sociology
Time: 01 (One) hour   Full Marks: 40

NB:
- Answer two questions including the compulsory question no.1 from this PART A.
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PART-A

			Marks	COs
1.	a)	What are capitalism and mode of production?	10	1
	b)	Define society. State the characteristics of society. How would you distinguish between society and community?	10	1
2.	a)	What is adaptive culture? Write down the characteristics and elements of culture.	10	1
	b)	'Family is the most important agent of socialization.' – Explain the statement.	10	1
3.	a)	What is meant by deviant behavior? Concisely discuss the facilitating factors of deviant behavior.	10	2
	b)	What is industrial society? What are the characteristics of industrial society?	10	2

Bangladesh Army University of Science and Technology
Department of Civil Engineering

Final (Online Live) Examination, Winter 2021   Level-1   Term-II
Course Code: HUM 1209   Course Title: Sociology
Time: 01 (One) hour   Full Marks: 40

NB:
- Answer two questions including the compulsory question no.4 from this PART B.
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PART- B

			Marks	COs
4.	a)	Define social stratification. Briefly discuss the estate system.	10	3
	b)	Differentiate between caste and class.	10	3
5.	a)	Identify the causes of population growth in Bangladesh.	10	2
	b)	Explain the 'Malthusian Population Theory'.	10	2
6.	a)	Discuss 'fairness' and 'interdependence' as the basic conditions of sustainable development.	10	2
	b)	'Sustainable development can hardly be initiated or implemented in the absence of genuine democracy'- Do you agree? Give reason in favor of your opinion.	10	2

NB:
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PART- A

Marks   COs

1. a) Explain linear circuit and non-linear circuit with examples.   05   1

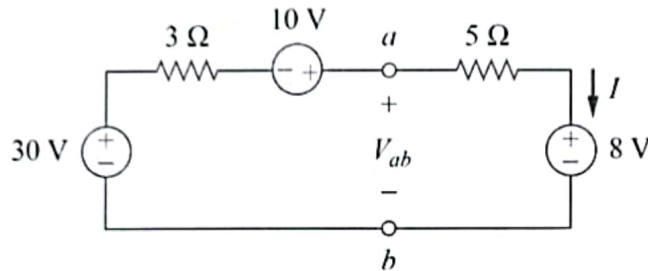   b) Find I and V_{ab} of the circuit shown in figure 1(b)   10   2

Figure 1(b)

    c) State Thevenin's Theorem. Using Theorem's theorem find Thevenin's equivalent circuit of the circuit shown in figure 1(c) to the ab terminal. Also find I.   15   3
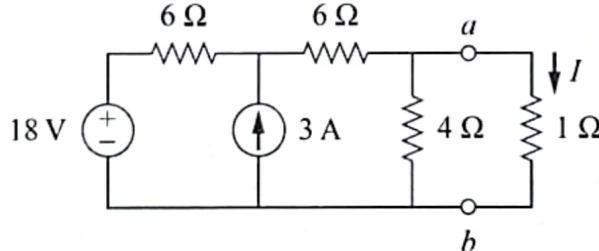
Figure 1(c)

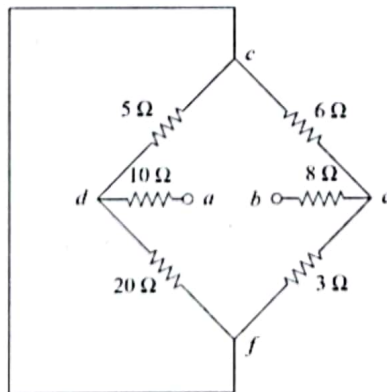2. a) Find the equivalent resistance R_{ab} of the circuit shown in figure 2(a).   12

Figure 2(a)

b) Calculate I_0 and voltage drop across 40 Ω resistance in the circuit shown in figure 2(b).   18
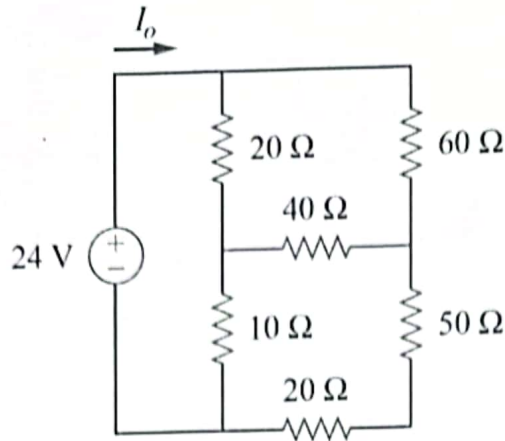

Figure 2(b)

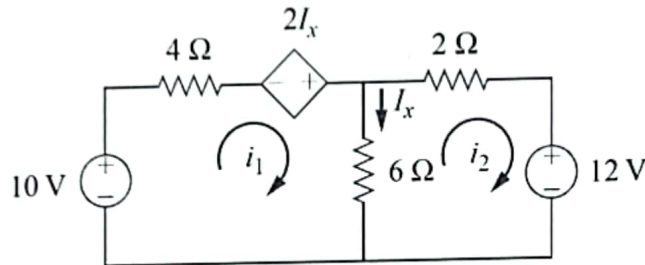3. a) Determine the mesh currents i_1 and i_2 of the circuit shown in figure 3(a).   12

Figure 3(a)

b) State and explain maximum power transfer theorem for a network.   18

Determine the value of resistance R that will draw maximum power from the rest of the circuit elements shown in figure 3(b). Also calculate maximum power at resistance 'R'.
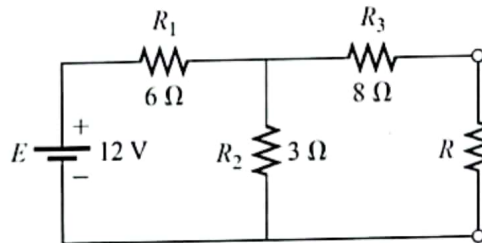

Figure 3(b)

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Final (Online Live) Examination, Winter 2021　　　　　　Level-1　Term-II
Course Code: EEE 1213　　　　　　　　　　　　Course Title: Electronics II
Time: 01 (One) hour　　　　　　　　　　　　　　　Full Marks: 60

NB:　　• Answer two questions including the compulsory question no.1 from PART B
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　　　　• The corresponding course outcomes (COs) are given in the right most column.

PART-B

		Marks	COs

1. a) Using the phasor approach, determine the current $i(t)$ in a circuit described by the following integrodifferential equation: — **15**　**1**

$$6i + 9\int i \, dt - 5\frac{di}{dt} = 60 \cos(2t+60^\circ)$$

   b) Write down the significance of the reactive power in an AC circuit. Determine $v_c(t)$ and $i(t)$ of the following circuit shown in Fig. 1(b). — **15**　**2**
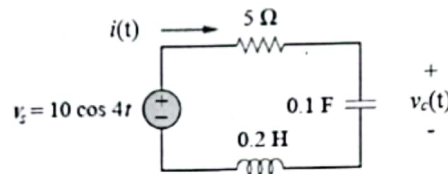

Fig. 1(b)

2. a) Define (i) peak value (ii) instantaneous value (iii) frequency with necessary wave shapes. Also show that in case of pure inductor current lags corresponding voltages by 90 degrees. — **08**

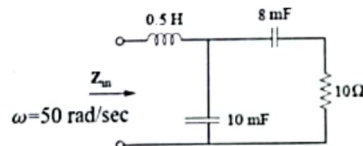   b) Find the input impedances of the following circuit as shown in Fig. 2(b). — **10**

Fig. 2(b)

   c) Explain causes of low power factor and problems associated with low power factor. Explain power factor improvement methods. — **12**

3. a) Determine the power factor of the entire circuit of Fig. 3(a) as seen by the source. Calculate the average power delivered by the source. — **10**
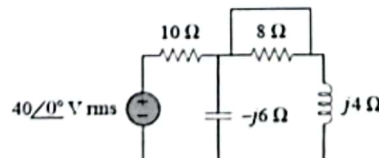

Fig. 3(a)

   b) Prove the following statement "Resistive load (R) absorbs power all times, while reactive load (L or C) absorbs zero average power". — **12**

   c) What is the importance of power factor correction? Differentiate between leading and lagging power factor. — **08**