Bangladesh Army University of Science and Technology
Department of Civil Engineering

Final (Online Live) Examination, Summer 2020   **Level-1 Term-II**
Course Code: CE 1211   **Course Title: Engineering Mechanics**
Time: 01 (One) hour   **Full Marks: 105**

N.B. (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART A

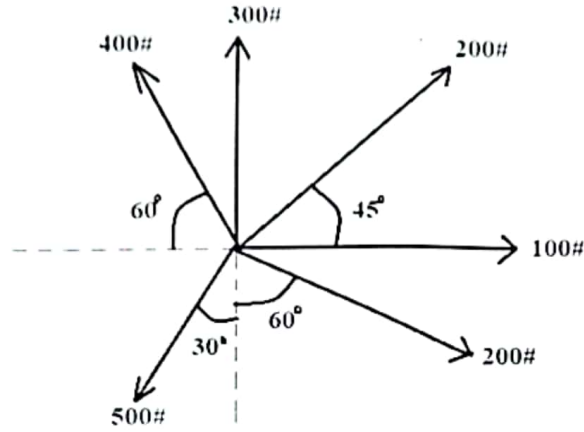1. a) Determine the resultants of the coplanar concurrent forces shown in Fig.1.   17

Fig 1

b) Calculate the support reactions of the simply supported beam AB as shown in Fig.2.   18
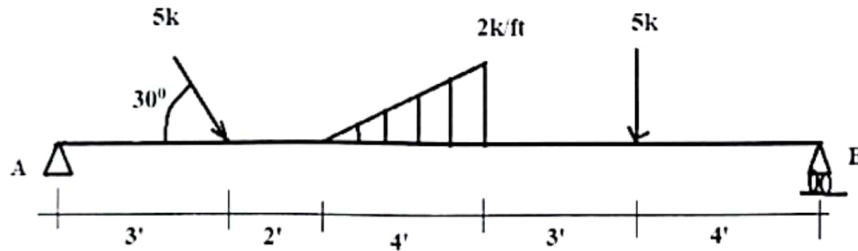

Fig. 2

2. Calculate member forces of the members AB, BC, BF, BG and FG of the truss shown in the Fig.3.   35
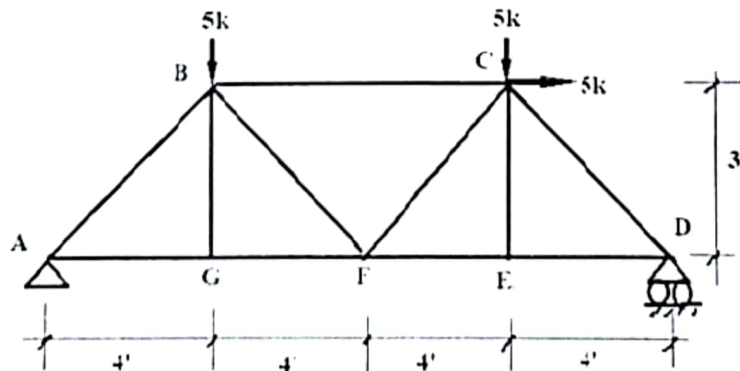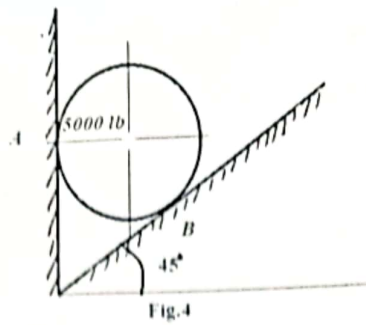

Fig. 3

3. a) A 5000 lb sphere rests on a smooth plane inclined at an angle 45° with the horizontal and against a smooth vertical wall. Determine the reactions at the contact surfaces A and B.

Fig.4

b) In Fig. 5, the bodies A and B weighing 250 N and 300 N, respectively are connected by a cord and rest on smooth inclined planes. Find the values of the angle θ and the reactions at the inclined planes, if the bodies are in equilibrium.

Smooth

Fig. 5
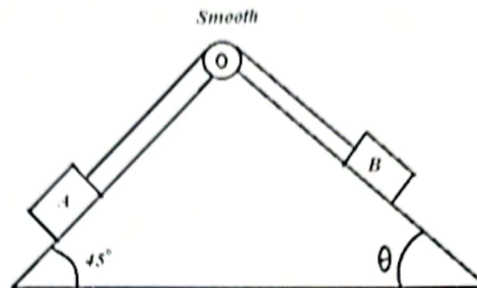
4. A ladder of length 5 m and weighing 300 N is placed against a vertical wall as shown in Fig. 35 6. The ladder also supports a man weighing 550 N. The coefficient of static friction between the wall and the ladder is 0.3 and that between the floor and the ladder is 0.2. Calculate the minimum horizontal force P to be applied at the bottom of the ladder to prevent slipping of the ladder.
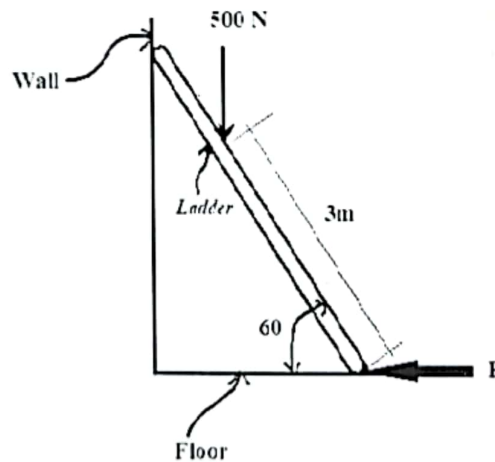
500 N

Wall

Ladder

3m

60

P

Floor

Fig. 6

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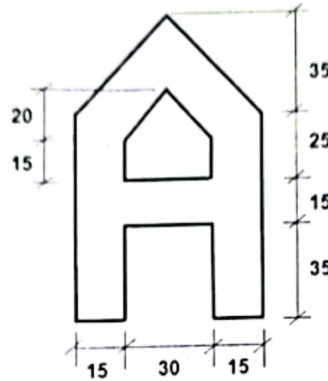Time: 01 (One) hour   Full Marks: 105

N.B. (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin
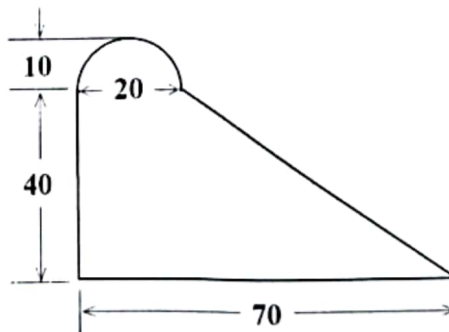   (iii) Symbols and abbreviations bear their standard meaning

PART B

5. a) Explain the terms 'Centroid' and 'Center of gravity'.   10

    b) Locate the centroid of the shape given below (Dimensions are in mm):   25

6. a) Explain moment of inertia.   5

    b) Determine the moment of inertia of the section given in the adjacent figure, with respect to its base line (Dimensions are in cm):   30

7. a) State the work-energy theorem.   5

    b) A particle is moving with rectilinear motion such that the acceleration is $a = 3t^2$ fps^2. When we start counting time, the speed is **4 fps**. Determine the **speed** and the **distance** after 6 sec.   30

8. a) State the Newton's Law of Motion.   10

    b) A body A weighing $W_A = 50$ lb. is on a plane inclined at an angle of 30^0. The coefficient of friction is $f_A = 0.3$. A cable attached to this body passes over a stationary member C, which is frictionless. From the other end of the cable is suspended a body B weighing $W_B = 100$ lb.   25

    Determine the tension in the cable and the speed of the body after they move 15 ft from rest. The weight of the cable is negligible
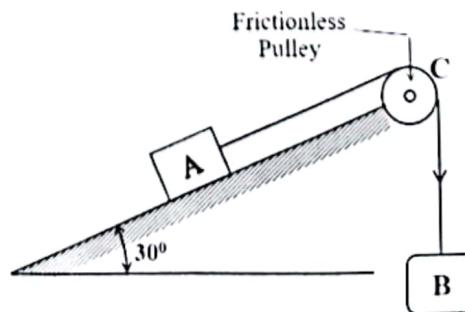
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Final (Online Live) Examination, Summer 2020   Level-1   Term-II
Course No: EEE 1213   Course Title: Basic Electrical Engineering
Time: 01 (one) hour   Full Marks: 105

N.B. (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin
     (iii) Symbols and abbreviations bear their standard meaning

PART A

1.   a)   Define short circuit and open circuit. State and explain Ohm's Law   15

    b)   Find R_{eq} and I in the circuit of Fig. 1(b).   20
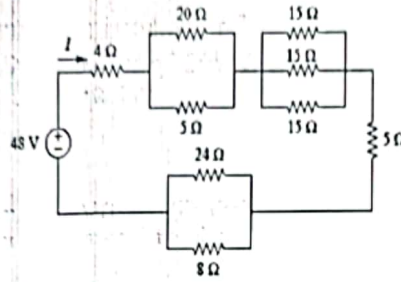
Fig. 1(b)

2.   a)   State and explain Kirchhoff's Voltage Law and Kirchhoff's Current Law.   15

    b)   Determine the mesh currents of the circuit in Fig. 2(b) using Mesh analysis   20
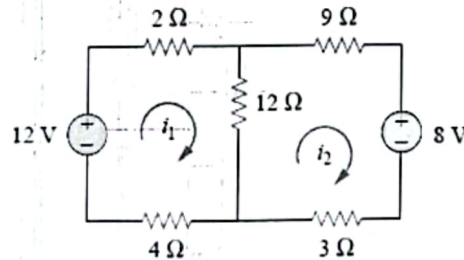
Fig. 2(b)

3.   a)   "Maximum power is transferred to the load when the load resistance equal to the Thevenin   15
        resistance as seen from the load ($R_L = R_{TH}$)", Justify the statement.

    b)   Using nodal analysis find the node voltages of the circuit of Fig. 3(b).   20
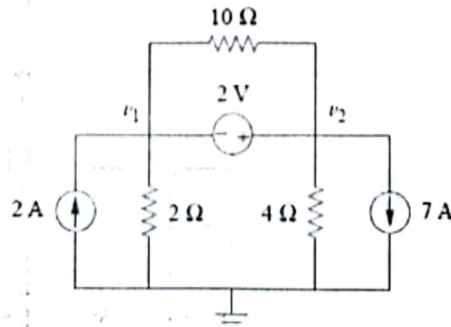
Fig. 3(b)

4. a) State Superposition Principle. Convert the Y network in Fig. 4(a) to an equivalent Δ network.   15

Fig. 4(a)

b) Use superposition principle find i_o in the circuit of Fig. 4(b).   20

Fig. 4(b)

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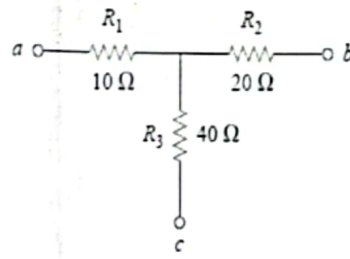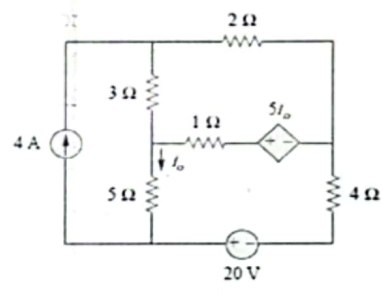
PART B

5. a) Explain (i) Instantaneous value, (ii) Peak Value, (iii) Cycle, (iv) Time period and (v) Frequency   20
with necessary wave shapes.

    b) The waveform shown in Fig. 5(b) is a full-wave rectified sine wave. Find (i) Peak Value (ii) RMS   15
value (iii) Average Value (iv) Crest factor and (v) Form factor
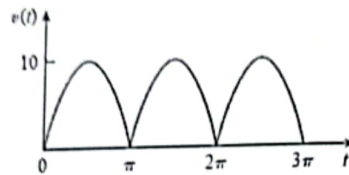
Figure 5(b)

6. a) Find the input impedance of the circuit in Fig. 6(a). Assume that the circuit operates at $\omega = 50$ 20
rad/s.
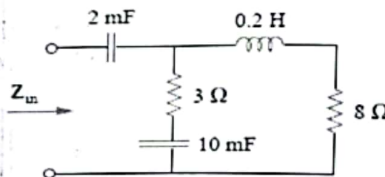
Figure 6(a)

    b) What is phasor? Draw the phasor diagram of R-L-C, R-L and R-C series circuits.   15

7. a) Define power factor. Explain different types of power factor. What do you mean by 0.88 lagging   15
power factor?

    b) Determine v_o in the circuit shown in Fig. 7(b).   20
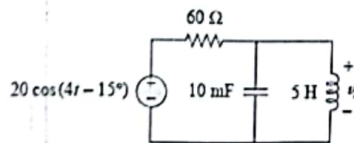
Figure 7(b)

8. a) What is magnetic circuit? Discuss the similarities as well as dissimilarities between electrical   15
circuit and magnetic circuit.

    b) Write a short note on the followings: 20
    (i) Magnetomotive Forec (ii) Reluctance (iii) Permenace (iv) Permeability

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Final (Online Live) Examination, Summer 2020   Level-1   Term-II

Course Code: MATH 1209   Course Title: Math-II (Ordinary and Partial Differential Equations and Matrices)

Time: 01 (One) hour   Full Marks: 105

N.B. (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin
      (iii) Symbols and abbreviations bear their standard meaning

PART A

1. a) Find the differential equation of $y = ae^{3x} + be^x$.   18

   b) Solve the DE: $x\sin y\,dx + (x^2 + 1)\cos y\,dy = 0$.   17

2. a) Solve the DE: $\frac{dy}{dx} + y = xy^3$.   30

   b) Write nth order homogeneous linear differential equation with constant coefficients.   5

3. a) Find the general solution of $\frac{d^2y}{dx^2} = \frac{1}{x}\left(\frac{dy}{dx} + x^2\cos x\right), x > 0$.   25

   b) Find the general solution of the DE: $(D^2 - D + 1)y = 0$.   10

4. a) Form a partial differential equation (PDE) by eliminating f from $x + y + z = f(x^2 + y^2 + z^2)$.   17

   b) Solve $\left(\frac{y^2 z}{x}\right)p + xzq = y^2$.   18

Bangladesh Army University of Science and Technology
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Final (Online Live) Examination, Summer 2020   Level-1   Term-II

Course Code: MATH 1209   Course Title: Math-II (Ordinary and Partial Differential Equations and Matrices)

Time: 01 (One) hour   Full Marks: 105

N.B. (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin
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PART B

5.   a)   Solve $(x^2 + y^2 + yz)p + (x^2 + y^2 - xz)q = (x+y)z$.   17

     b)   Find the complete integral and singular integral of $p^3 + q^3 = 27z$ 18

6.   a)   Solve $(D^2 + 2DD' + D'^2)z = e^{3x+4y}$.   15

     b)   Determine the values of α, β, γ when $A = \begin{bmatrix} 0 & 2\beta & \gamma \\ \alpha & \beta & -\gamma \\ \alpha & -\beta & \gamma \end{bmatrix}$ is orthogonal.   20

7.   a)   Find the inverse of the matrix $A = \begin{bmatrix} 1 & -2 & 3 \\ 3 & 1 & 5 \\ 4 & 6 & 7 \end{bmatrix}$.   25

     b)   Show that $A = \begin{bmatrix} 1 & 1+i & 2+3i \\ 1-i & 2 & -i \\ 2-3i & i & 0 \end{bmatrix}$ is Hermitian.   10

8.   a)   Find the characteristic roots of the matrix, $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ and verify Cayley-Hamilton theorem for it.   35

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Final (Online Live) Examination, Summer 2020   Level-1   Term-II
Course Code: PHY 1209   Course Title: Physics II
Time: 01 (One) hour   Full Marks: 105

N.B.: (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin
      (iii) Symbols and abbreviations bear their standard meaning

PART A

1. a) Define electric field. Deduce the relation, $E = \frac{\lambda}{2\pi\varepsilon_0 a}$.   25

    b) A negative charge of 10^{-6} C is situated in air at the origin of a rectangular co-ordinate   10
        system. A second negative point charge of 10^{-4} C is situated on the positive x-axis at a
        distance of 50 cm from the origin. What will be the force on the second charge?

2. a) State and prove Gauss's law of electrostatic.   20

    b) A silver wire of 1 mm in diameter carries a charge of 90 Coulomb in 1 hr. Silver contains   15
        5.8×10^{28} free electrons/m^3. Calculate: i) the current in the wire and ii) current density
        and drift velocity of electrons in the wire.

3. a) Applying Ampere's law, calculate the magnetic field for a long solenoid.   22

    b) A solenoid is 1.0 m long and 3.0 cm in mean diameter. It has 5 layers of winding of 850   13
        turns each and carries a current of 5.0 amps. What is B at its centre? What is magnetic
        flux φ_B for a cross section of the solenoid at its centre?

4. a) Define fringe width. Calculate the fringe width in the case of Young's double slit   25
        experiment.

    b) Light wavelength of 5500 Å from a narrow slit is incident on a double slit. The overall   10
        separation of 5 fringes on the screen 200 cm away is 1 cm. Calculate: i) slit separation and
        ii) fringe width.

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Final (Online Live) Examination, Summer 2020   Level-1   Term-II
Course Code: PHY 1209   Course Title: Physics II
Time: 01 (One) hour   Full Marks: 105

N.B.: (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART B

5. a) Describe the Fraunhoffer diffraction pattern produced by a single slit illuminated by monochromatic light. Prove that, the width of the central maximum is proportional to the wavelength of light.   25

   b) Refractive index of water is 1.33. Calculate the angle of polarization of light reflected from the surface of a pond. Also calculate the angle of refraction.   10

6. a) Show that $E = mc^2$.   25

   b) The total energy of a particle is exactly twice its rest mass energy. Calculate its speed.   10

7. a) Prove that $\lambda' - \lambda = \frac{h}{m_0 c}(1 - cos\varphi)$.   25

   b) A monochromatic X-ray of wavelength 0.124 Å is scattered by a carbon block. Find the wavelength of X-rays scattered through an angle of 180°.   10

8. a) Deduce an expression for Rutherford-Soddy theory in radioactivity and explain it with diagram.   22

   b) The disintegration constant of a radioactive element is 0.0693 per month. Calculate the time required for 75% at the element to decay.   13

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Final (Online Live) Examination, Summer 2020   Level-1   Term-II
Course Code: HUM 1209   Course Title: Sociology
Time: 01 (One) hour   Full Marks: 70

N.B. (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin

PART A

1. a) What are industrial revolution and mode of production?   10

   b) Define technology? Distinguish between science and technology. $13\frac{1}{3}$

2. a) 'Material culture changes rapidly than non-material culture'- Do you agree with this statement? Give reason in favor of your opinion. $10\frac{1}{3}$

   b) What is an agent of socialization? According to you which one is the most important agent of socialization? Discuss in brief.   13

3. a) What is association? Point out the characteristics of association. Show some differences between association and institution. $10\frac{1}{3}$

   b) Define development and sustainable development. Discuss the features of development.   13

4. a) What is collective behavior? Discuss the forms of collective behavior. $13\frac{1}{3}$

   b) How would you define social movement? Explain the 'Relative deprivation' theory.   10

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Final (Online Live) Examination, Summer 2020   Level-1   Term-II
Course Code: HUM 1209   Course Title: Sociology
Time: 01 (One) hour   Full Marks: 70

N.B. (i) Answer any three questions from this PART   (ii) Marks allotted are indicated in the margin

PART B

5. a) What is social control? Distinguish between crime and deviant behavior.   10

   b) Discuss the main causes of crime. $13\frac{1}{3}$

6. a) Define social stratification. Briefly discuss the slavey system. $10\frac{1}{3}$

   b) What are the causes of population problem in Bangladesh? State some measures to solve the problem.   13

7. a) Explain the classification of marriage on the basis of choice of mates. $10\frac{1}{3}$

   b) What is levirate marriage? Discuss the types of marriage on the basis of number of mates.   13

8. a) 'Democracy is the purest form of government but probably most difficult to achieve.'- Explain it. $10\frac{1}{3}$

   b) What is monarchy? What are the corrupt forms of government according to Aristotle?   13