BANGLADESHUNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-1   B.Sc. Engineering Examination 2019-2020
Sub: MME 101 (Materials Engineering Fundamentals)
Full Marks: 180   Time: 2 Hours
The figures in the margin indicate full marks.
USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A
There are FOUR questions in this script. Answer any THREE.

1. (a) The 4th Industrial Revolution will see the convergence of multiple digital fields, including robotics, AI and machine learning, nanotechnology, 3D printing and biotechnology. As a materials engineer what role can you play in this era?   **(10)**

   (b) As a quality control expert, you are requested to determine the type and presence, if any, of welding defects of welded pipeline. Select any suitable nondestructive testing method, clearly indicating the reasons for such selection and explain how you would perform the test?   **(20)**

2. (a) Compare wrought iron, cast iron and steel based on composition, properties, and applications.   **(15)**

   (b) Which ceramic processing method will you choose to produce hollow bricks? Justify your answer.
                                                                                              (15)

3. What general information can you get from the charts shown in Figure 1 and Figure 2? With the help of these charts select materials for the following products and explain reasons for such selections.   **(30)**

   i)   A saucepan.
   ii) A mould for casting aluminium parts (melting temp 660°C)
   iii) A disposable cup

4. (a) What is coring in metallurgy? With schematic view, show the development of microstructures of an isomorphous alloys during fast (non-equilibrium) cooling.   **(15)**

   (b) From the data given below for Cu-Ni system, plot the equilibrium diagram to scale and label the diagram. Answer the following for 70% Ni alloy: **(15)**

   (i) What is the composition of first solid crystallizing out from liquid.
   (ii) What are the amounts of solids and liquids at 1360 °C?

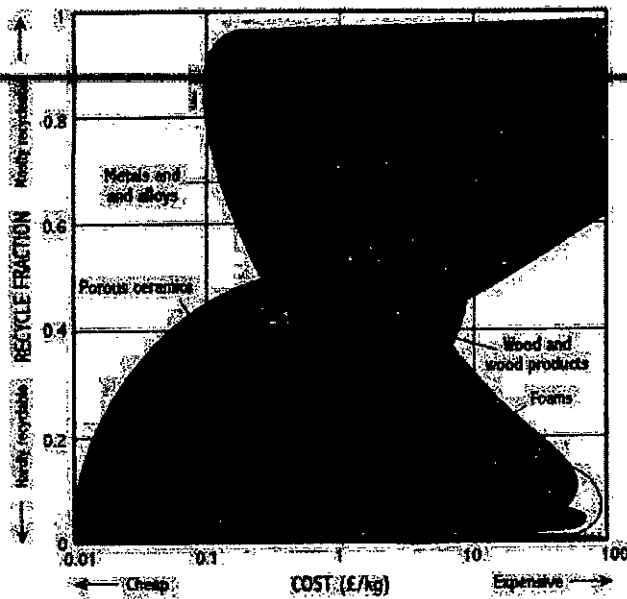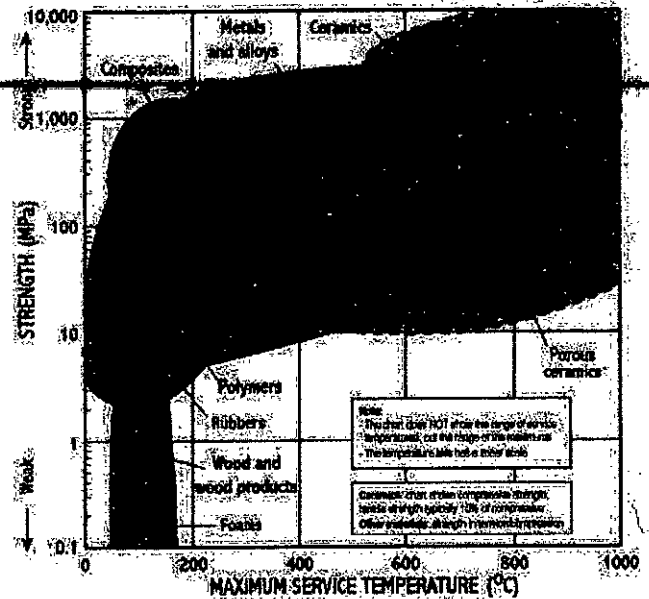| Weight % Ni	0	20	40	60	80	100
Liquidus temperature, °C	1084	1200	1275	1345	1440	1455
Solidus temperature, °C	1084	1165	1235	1310	1380	1455

Figure. 1

Figure. 2

SECTION-B

There are **FOUR** questions in this script. Answer any **THREE**.

5. (a) Why are the physical properties of FCC metals markedly different from that of HCP metals though having the same atomic packing factor? **(10)**

(b) Explain co-ordination number with examples. With the help of labelled diagrams, calculate the atomic packing factor of an FCC crystal structure. **(20)**

6. (a) With the help of labelled diagrams, state the sequence leading to cup and cone fracture. **(12)**

(b) Distinguish between resilience and toughness of materials. **(06)**

(c) A cylindrical specimen of steel having an original diameter of 12.8 mm is tensile tested to fracture and found to have an engineering fracture strength of 460 MPa. If its cross-sectional diameter at fracture is 10.7 mm, determine ductility in terms of percent reduction in area and the true stress at fracture. **(12)**

7. (a) Explain the factors that increase the tendency of a ductile material to brittle failure. **(10)**

(b) What is fatigue life and fatigue strength? Explain how can the fatigue life of an alloy be improved? **(20)**

8. (a) What do you understand by solid solution? What are the factors that affect the degree to which solute atom dissolves in solvent? **(10)**

(b) What is strain hardening? Why do materials strain harden? **(07)**

(c) What are grain boundaries? Explain the strengthening mechanism of materials by grain size reduction. **(13)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B.Sc. Engineering Examination 2018-19

Sub: **EEE 155** (Electrical Engineering Fundamentals)

Full Marks: 180   Time 2 Hours

The Figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

There are 7 page(s) in this question paper.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**

All the symbols have their usual meanings

Assume reasonable values for missing data.

1.   (a) A power supply is driving two appliances - a bulb and a fan. The instantaneous   (25)
     real power absorbed by the bulb is given in Fig. for Q. No. 1(a)-(i). Also, the
     instantaneous voltage in volt·unit across the fan is given in Fig. for Q. No. 1(a)-
     (ii). The resistance of the bulb and the fan is 10 Ω each.

     Find the total average real power delivered by the power supply.

     If you connect a capacitor parallel to the power supply, what will be the change
     in the real power delivered by the source? Will it increase, or decrease? Why?
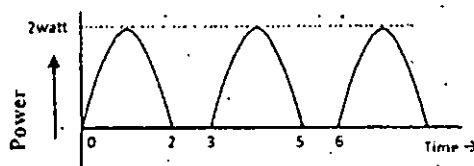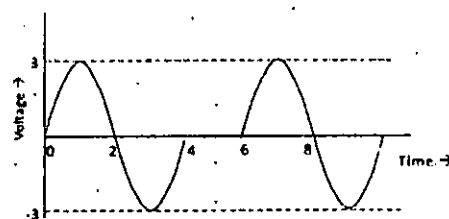
(i)   (ii)

Fig. for Q. No. 1(a)

(b) Find the wave form for voltage across the coil, if the current through a 4 mH   (05)
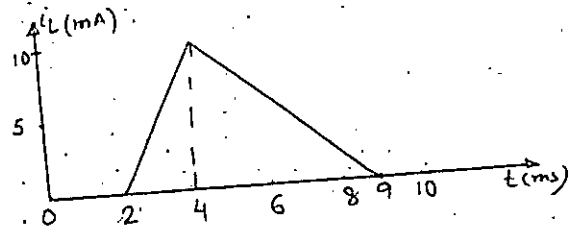   coil is as shown in Fig. for Q. No. 1(b).

Fig. for Q. No. 1 (b)

2. (a) Find the reactive component of the unknown element in Fig. for Q. No. 2(a) (20) which makes the power factor of the circuit unity.

If the power supplied by the source is 200 Watt, then what is the resistive component of the unknown element? Assume the source frequency to be 50 Hz.
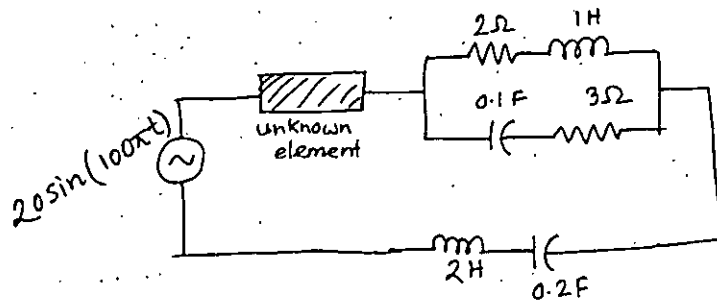

Fig. for Q. No. 2(a)

(b) Determine V_{ab} for the circuit in Fig. for Q. No. 2 (b). (10)
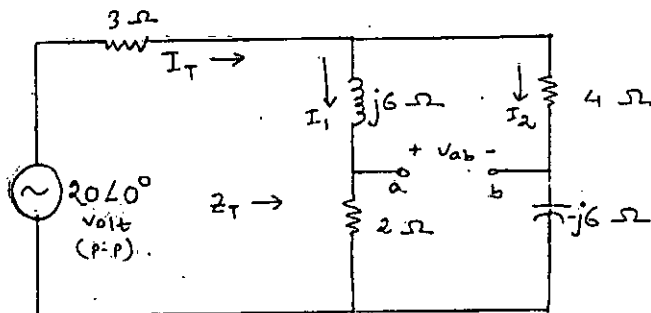

Fig. for Q. No. 2 (b)

3. (a) (i) If you are asked to solve the circuit in Fig. for Q. No. 3(a) by applying (20) either mesh or node analysis, which of the two methods will you choose? Why?

(ii) Find out the current through V1 source by applying your preferred method. Also find its power factor. Here,

V1=10sin(100πt)

V2=20cos(100πt+60°)

L1=L2=12.7 mH

C=3.18 mF

R=4 Ω

(iii) Also, what is the frequency of the system? For what value of the frequency, the voltage across the middle branch (consisting of C and L2) will be zero?
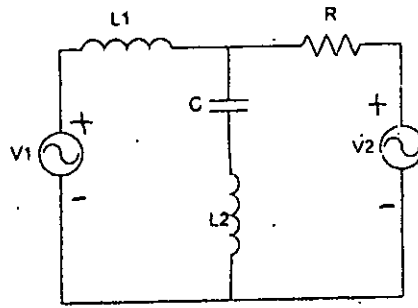

Fig. for Q. No. 3(a)

(b) A 10 hp motor is operating at 0.5 lagging power factor with a 50 Hz power (10) supply. To improve the power factor, a capacitor bank is connected in parallel to the motor. For what value of the capacitance, the motor will run at 0.95 leading power factor? 1 hp=746 Watt.

4. (a) Find the value of I required to establish a magnetic flux $\varphi = 0.75 \times 10^{-4}$ wb in (20) Fig. for Q. No. 4(a). The Stacking Factor for the laminated sheet steel is 0.95. Also consider fringing effect.
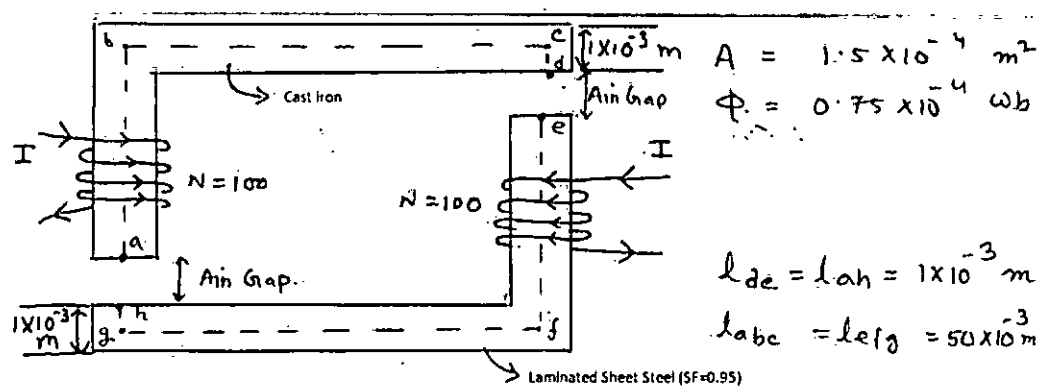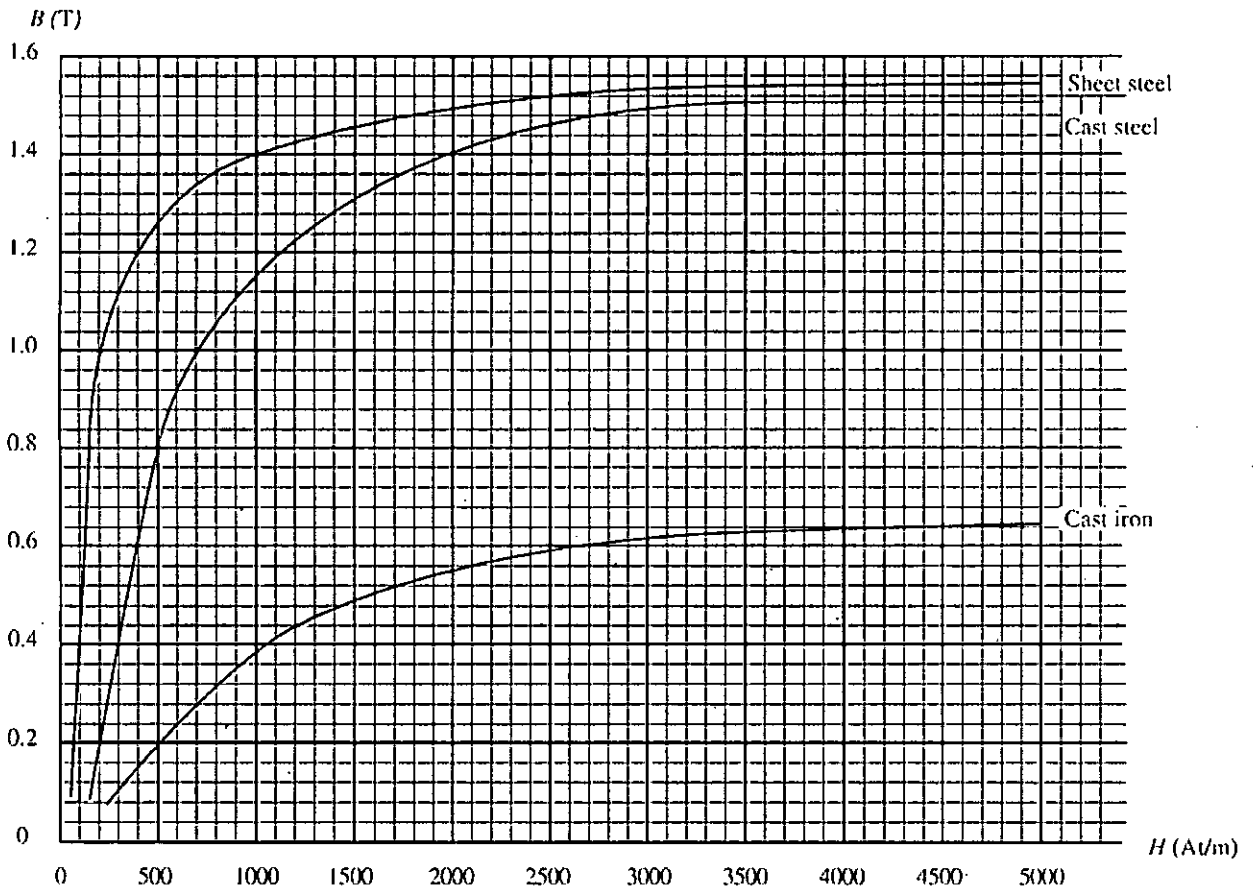

$A = 1.5 \times 10^{-4} \ m^2$

$\varphi = 0.75 \times 10^{-4} \ wb$

$\ell_{de} = \ell_{ah} = 1 \times 10^{-3} \ m$

$\ell_{abc} = \ell_{efg} = 50 \times 10^{-3} \ m$

Fig. for Q. No. 4(a)

(b) A voltage v = 200 cos(157t + 30°) volts is applied to a particular circuit (10) element, and it is found that i = 5 sin(157t - 150°) amperes. Sketch v and i waves. Determine the nature and magnitude of the circuit parameter/parameters.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**

All the symbols have their usual meanings

Assume reasonable values for missing data.

5. (a) Find the power dissipated in the 1 Ω resistor in the circuit shown using the (15) mesh-current method.

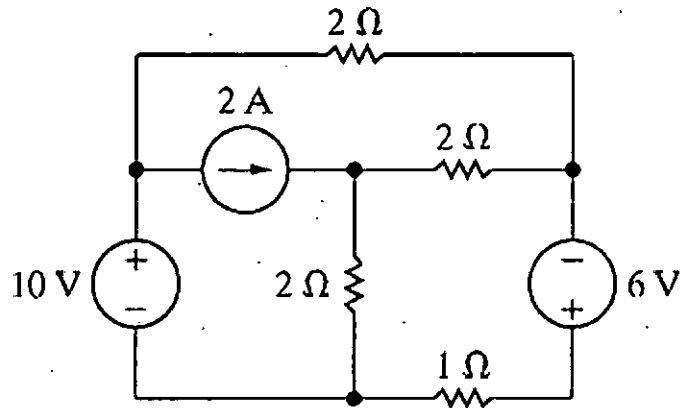Fig 5(a)

(b) The voltage and the current at the terminals of a circuit is given below: (15)

$$v = 50e^{-1600t} - 50e^{-400t} \text{ V}$$

$$i = 5e^{-1600t} - 5e^{-400t} \text{ mA}$$

Find the power at $t = 625\mu s$. How much energy is delivered to the circuit between 0 and $625\mu s$.

6.   (a) Find the equivalent resistance R_{ab} from the following circuit.   (20)

Fig 6(a)

(10)
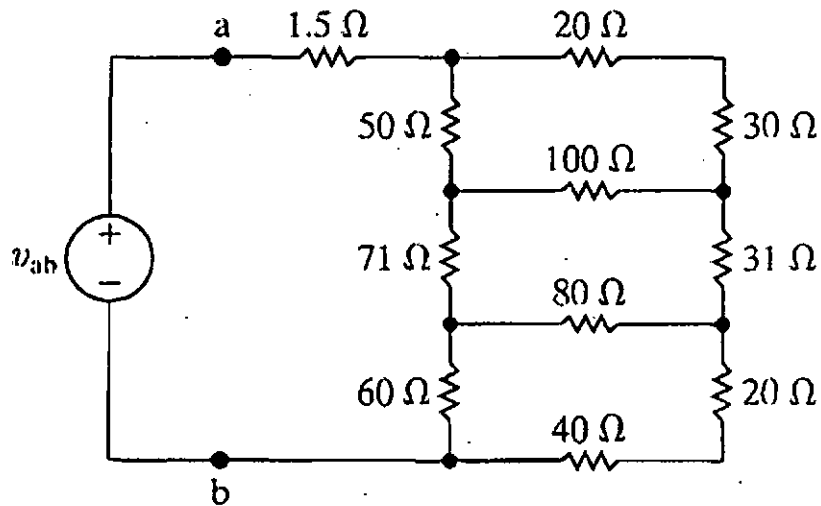
(b) Find the value of the variable resistor R_o in the circuit that will result in maximum power dissipation in the 6Ω resistor. Also calculate the maximum power that can be delivered to the resistor.
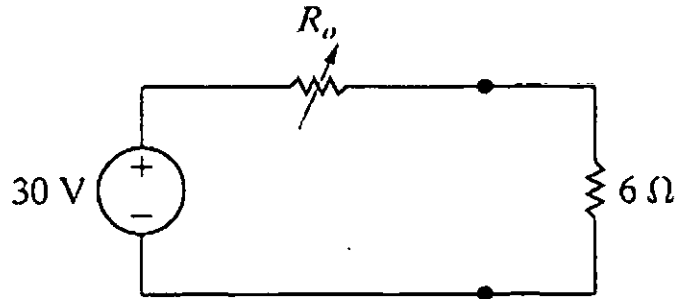
Fig 6(b)

7.   (a) For the circuit below find v_1, v_2 and v_3.   (15)
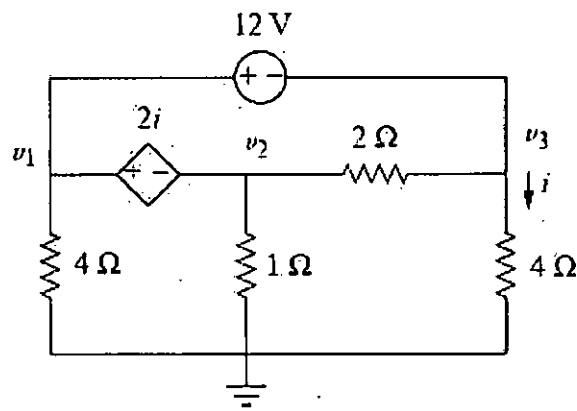

Fig 7(a)

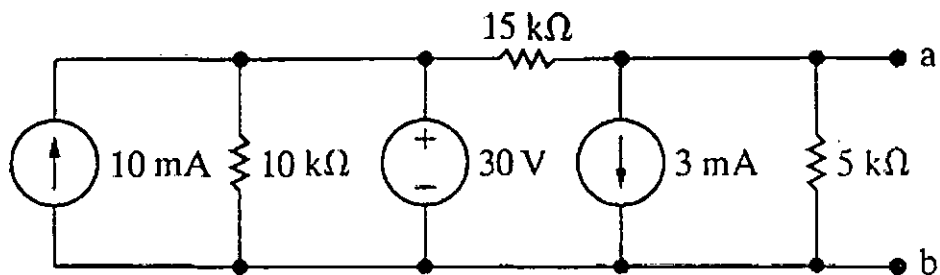(b) Find the Norton equivalent circuit with respect to the a-b terminals.   (15)

Fig 7(b)

8. (a) Find the power associated with the 6V source. Also state whether the source (15) is absorbing or delivering the power.
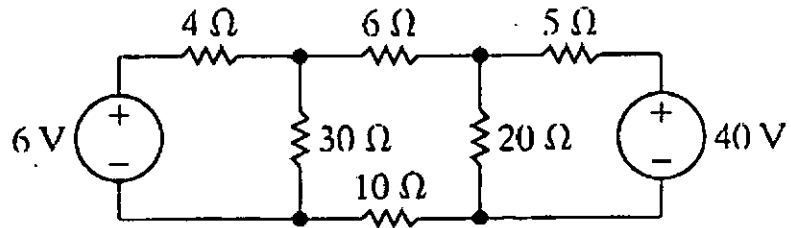

Fig 8(a)

(b) Explain superposition theorem. Calculate v_0 using superposition theorem. (15)
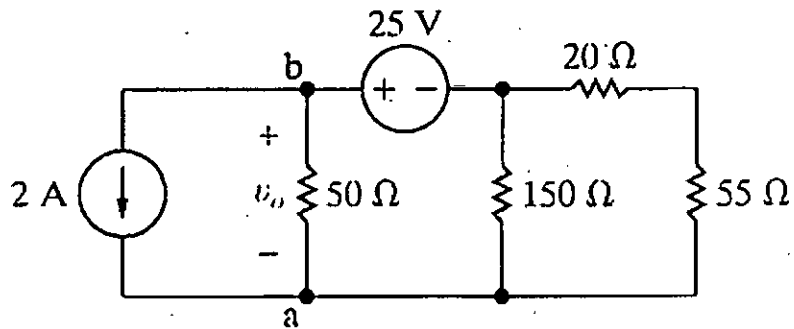
Fig 8(b)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

B. Sc. Engineering Examinations January 2020

Sub: **PHY 125** Physics I (Optics, Waves & Oscillation and Electricity & Magnetism)

Full Marks: 180   Time: 2 Hours

The figures in the margin indicate full marks. Symbols have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Figure 1 shows a slit AB of width d. This slit is divided into five imaginary slits.   **(10)**
   A plane wave front of monochromatic light is incident on the surface of AB slit.
   The diffracted waves make an angle α with the direction of the incident wave.
   The phase and path difference between any two successive diffracted waves are
   $\Delta\theta$ and Δy, respectively. Draw a phasor diagram for these diffracted waves in
   figure 1.
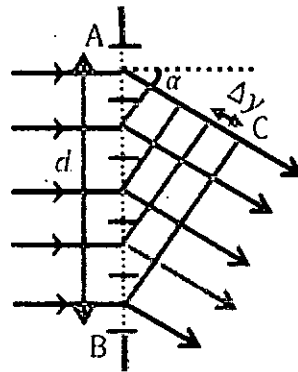
Figure 1

   (b) Calculate the resultant amplitude of the diffracted waves in terms of the total   **(20)**
   phase difference using the drawn phasor diagram in question 1(a).

2. (a) Explain, why the anisotropic materials show two refracted rays.   **(06)**

(b) An anisotropic crystal splits the polarized light into two refracted rays called the (24) fast ray and slow ray, as shown in figure 2. These two rays are mutually perpendicular to each other. The velocities of the slow and fast rays are C_1 and C_2, respectively. At a certain time, the slow ray lags behind the fast ray by an extra path, δ. Find the value of δ in terms of the refractive indices of these two rays and the thickness (D) of crystal.
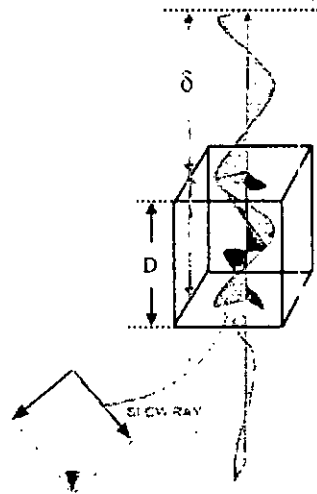
Figure 2

3. (a) Newton's rings are observed when a beam of monochromatic light AB is incident (24) at the point B on the curve surface of a plano-convex lens placed on a plane mirror, as shown in figure 3.

(i) Explain why a dark spot is observed in the center of the interference pattern due to reflected light.

(ii) Find the diameter of the 10th dark ring in terms of the radius of curvature (R) of the lens and the wavelength (λ) of light.
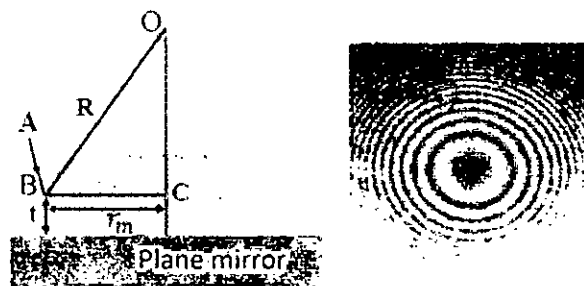
Figure 3

(b) Newton's rings are observed in the reflected light of wavelength 589 nm. The **(06)** diameter of the 10th dark ring is 0.5 cm. Find the radius of curvature the lens and the thickness of the air film.

4. (a) On the basis of principle of superposition, establish the resultant equation of **(15)** motion of an object simultaneously acted upon by two mutually perpendicular simple harmonic vibrations having equal frequencies, different phases and same amplitudes.

(b) From the deduced equation in part (a), analyze the resultant path of the object **(15)** when the phase angles between the incident simple harmonic vibrations are 0, $\pi/4$ and $\pi/2$ rad.

SECTION-B
There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Establish the equation of motion of spring vibrating in a viscous fluid medium. **(22)** What happens when the influence of viscous force is very negligible?

(b) A damped harmonic oscillator of mass 3.5 kg experiences a damping force with **(08)** the damping constant 90 Kg/s and force constant 125 N/m. The initial amplitude of oscillation is 0.49 m. Find out the kinetic energy of the oscillator at time 20 s.

6. (a) A stationary wave is created in a string fixed at both ends. Derive the expressions **(22)** of particle displacement, particle velocity, acceleration and strain of the stationary wave.

(b) The equation of particle displacement of a stationary wave is, **(08)** $y=2.4\ cos3.5x\ sin4.5t$ (in cm). Find out the distance between a node and the next antinode.

7. (a) Discuss the validity of Gauss's law in terms of symmetry distribution of charges. Obtain **(20)** Coulomb's law for the force between two point charges using Gauss's theorem.

(b) An infinite line of charge carries a linear charge density of 2.55×10^{-5} C/m. Calculate **(10)** the electric field $\vec{E}$ at a distance of 15.5 cm from the line of charge.

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8. (a) Explain the difference between Ohmic and non-Ohmic conductors. State the conditions **(15)** under which Ohm's law is not obeyed.

(b) Derive a mathematical expression for the force acting on a straight metal wire of length **(15)** 'l' carrying a current 'i' placed at right angles to uniform magnetic field $\vec{B}$ is $\vec{F} = i\,\vec{l} \times \vec{B}$.

L-1/T-1/MME   Date: 18/01/2021
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-1   B. Sc. Engineering Examinations 2018-2019
Sub: MATH 171 (Calculus and Differential Equations)
Full Marks: 180   Time: 2 Hours
USE SEPARATE SCRIPTS FOR EACH SECTION
The figures in the margin indicate full marks.
Symbols used have their usual meaning.

SECTION-A

There are FOUR questions in this section. Answer any THREE.

1.
(a) Sketch the graph of the function $f(x) = \dfrac{x^2 - 9}{x + 3}$. Calculate Left hand limit and (15)

Right hand limit of $f(x)$ at $x = -3$. Is $f(x)$ continuous at $x = -3$? Explain.

(b) Sketch the graph of the function $f(x) = \begin{cases} 2, & \text{if } x \le -2 \\ -\sqrt{4 - x^2}, & \text{if } -2 < x < 2 \\ 2 - x, & \text{if } x \ge 2 \end{cases}$ (15)

and write down the domain and range. Discuss the continuity of $f(x)$ at $x = -2$ and $x = 2$.

2.
(a) Sketch the graph of $f(x) = \begin{cases} 1 - x^2 & \text{for } x < 0 \\ 1 & \text{for } 0 \le x < 1 \\ \frac{1}{x} & \text{for } x > 1 \end{cases}$ (20)

and discuss differentiability at $x = 0$ and at $x = 1$.

(b) If $y = e^{m \cos^{-1} x}$ then show that $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 + m^2)y_n = 0$. (10)

3. (a) If $u(x,y)$ is a homogeneous function in x and y of degree n, then show that (15)
$x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy} = n(n-1)u$.

(b) Find the relative extrema of $f(x) = 3x^5 - 5x^3$. Discuss concavity, points of (15) inflection and sketch the graph.

4. Workout the following integrals:

(a) $\displaystyle\int \frac{dx}{\sqrt{x}(1+x)^{5/2}}$ (15)

(b) $\displaystyle\int \frac{dx}{4 + 5\cos x}$ (15)

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.

5. Evaluate the following: (30)

(a) $\displaystyle\int_0^{\frac{1}{a}} \frac{\ln(ax)}{\sqrt{1-a^2x^2}}\,dx$

(b) $\displaystyle\int_3^{\infty} \frac{dx}{x^2-2x}$

6. (a) Find the area between the curve $y^2 - 2x = 0$ and the straight line $x - y - 4 = 0$ (15)

(b) Find the volume of the solid formed by revolving the curve $\dfrac{r}{2k} = \cos^2\left(\dfrac{\theta}{2}\right)$ about (15) the initial line where k = last digit in your student number and k = 10 when last digit in your student number is equal to zero.

7. Solve the following differential equations: (30)

(a) $(x^2 + 2xy + y^2)\dfrac{dy}{dx} = a^2$

(b) $(1+x^k)\tan y \dfrac{dy}{dx} = kx^{k-1} + 2xe^{kx^2}(1+2x^k+x^{2k})\cos y$

where k = last digit in your student number and k = 10 when last digit in your student number is equal to zero.

8. Solve the following: (30)

(a) $(D^3 - 3D + 2)y = e^{-2x} + \sin x$

(b) $(x^2D^2 - 3xD + 5)y = \ln x \sin(\ln x)$

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T1 B.Sc. Engineering Examinations, January 2020

Sub:.HUM 123 (English)

Full Marks: 180   Time 2 Hours

The Figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

There are 4 page(s) in this question paper.

SECTION – A

There are FOUR questions in this section. Answer Q. No 1 and any TWO from the rest.

Figures in the brackets indicate the marks of the questions

1. Answer <u>any one</u> of the following   (20)

   (i) In "The Rocking-Horse Winner" by D. H. Lawrence, Hester tells her son that it is better to be lucky than rich. Do you agree with her reasoning? Substantiate your argument.

   (ii) Compare the characters of the astrologer and Guru Nayak in "An Astrologer's Day".

2. (a) Explain with reference to the context <u>any one</u> of the following: (15)

   (i) "I perceived in this moment that when the white man turns tyrant it is his own freedom that he destroys."

   (ii) "To crown the effect he wrapped a saffron-colored turban around his head. This color scheme never failed."

   (b) Answer <u>any two</u> of the following: (20)

   (i) Why does Ralph want to make fire on top of the mountain?

   (ii) How does Orwell's position force him into a situation that he would rather avoid?

   (iii) What is the 'whispering' and what does it symbolize in "The Rocking-Horse Winner"?

3. Amplify <u>any one</u> of the following: (35)

(i) A bird in hand is worth two in the bush.

(ii) A journey of thousand miles begins with a single step.

4   Write a précis of the following passage with a suitable title: (35)

Home is the young, who known "nothing of the world and who would be forlorn and sad, if thrown upon it. It is providential, shelter of the weak and inexperienced, who have to learn as yet to cope with the temptations which lies outside of it. It is the place of training of those who are not only ignorant, but have not yet learnt how to learn, and who have to be taught by careful individual trail, how to set about profiting by the lessons of teacher. And it is the school of elementary studies—not of advances, for such studies alone can make master minds. Moreover, it is the shrine of our best affections, the bosom of our fondest recollections, at spell upon our after life, a stay for world weary mind and soul; wherever we are, till the end comes. Such are attributes or offices of home, and like to these, in one or other sense or measure, are the attributes and offices of a college in a university.

SECTION – B

There are FOUR questions in this section. Answer Q.No.5 and any TWO from the rest.

Figures in the brackets indicate the marks of the questions

5.   Read the passage below and answer the questions that follow: (5x4=20)

The other day we heard someone smilingly refer to poets as dreamers. Now it is accurate to refer poets as dreamers, but it is not discerning to infer, as this person did, that the dreams of poets have no practical value beyond realm of a literary diversion. The truth is that poets are just as practical as people who build bridges or look into microscopes; and just as close to reality and truth. Where they differ from the logician and the scientist is in the temporal sense alone; they are ahead of their time, whereas logicians and scientists are abreast of their time. We must not be so superficial that we fail to discern the practicableness of dreams. Dreams are the sunrise streamers heralding a new day of scientific progress, another forward surge. Every forward step man takes

in any field of life, is first taken along the dreamy paths of imagination. Robert Fulton did not discover his steamboat with full steam up, straining at a hawser at some Hudson River dock; first he dreamed the steamboat, he and other dreamers, and then scientific wisdom converted a picture in the mind into a reality of steel and wood. The automobile was not dug out of the ground like a nugget of gold; first men dreamed the automobile and afterward, long afterward, the practical-minded engineers caught up with what had been created by winging fantasy. He who looks deeply with a seeing eye into the poetry of yesterday finds there all the cold scientific magic of today and much which we shall not enjoy until some tomorrow. If the poet does not dream so clearly that blueprints of his vision can immediately be drawn and the practical conversions immediately effected, he must not for that reason be smiled upon as merely the mental host for a sort of harmless madness. For the poet, like the engineer, is a specialist. His being, tuned to the life of tomorrow, cannot be turned simultaneously to the life of today. To the scientist he says, "Here I give you a flash of the future." The wise scientist thanks him, and takes that flash of the future and makes it over into a fiber of today.

Questions:

a) What provoked the writer's writing this piece?

b) Explain the statement: 'first men dreamed the automobile and afterward, long afterward, the practical-minded engineers caught up with what had been created by winging fantasy.'

c) How is a poet different from a logician and/or a scientist? In what sense a poet is a specialist like an engineer?

d) According to the passage should the poetic dreams and visions be clearly blueprinted and converted immediately? Why or why not?

6. a) In what way is a quotation letter different from a notice inviting tenders? (10) Discuss in detail.

b) Imagine that you are Ceramics Engineer in Monnu Ceramic Industries Ltd. (25) A month ago your company bought a machine from a firm in Dhaka. The

machine does not work well. As an engineer and production in charge of the company write a letter to the firm (from where the machine was purchased) detailing the problem and request a replacement or a repair. Use imagined address where necessary.

7. a) Write a note on the importance of being formal and informal in our   (10)
        conversation. Give examples of formal, informal, very informal expressions
        referring to the contexts.

    b) During the corona virus pandemic the word 'lockdown' has found a special (25)
        meaning. Write a dialogue between you and your friend about lockdown
        and its impact in our life.

8. Write an essay on **any one** of the following: (35)
    (a) How to Develop the Vocational Education in Bangladesh
    (b) Global Environmental Pollution: Challenges for Bangladesh