L-2/T-1/EEE **Date: 06/05/2023**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2021-2022

Sub: **EEE 201** (Electronic Circuits I)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

Q. No. 1 is COMPULSORY.

All the symbols have their usual meaning.

Assume reasonable values for missing data, if necessary.

1. (a) The bulb in the Fig. for Q. 1(a) is operated by a CMOS circuit. Design a CMOS circuit to alternately ON/OFF the bulb using the given pulse train of negative voltage, v_i. Explain the operation. **(20)**

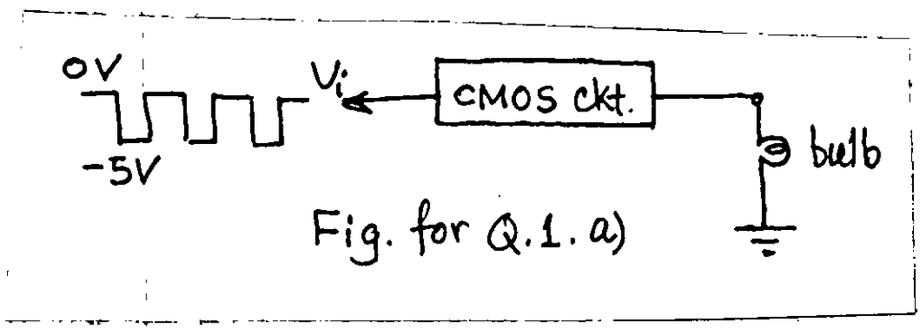

Fig. for Q.1.a)

(b) Explain operation of the diode circuit shown in Fig. for Q. 1(b) and sketch time variation of the voltage across R, (v_o vs t) for the given v_i. Assume forward voltage drop across D1, D3 to be 0.6 V and that across D2, D4 to be 0.75 V. **(15)**

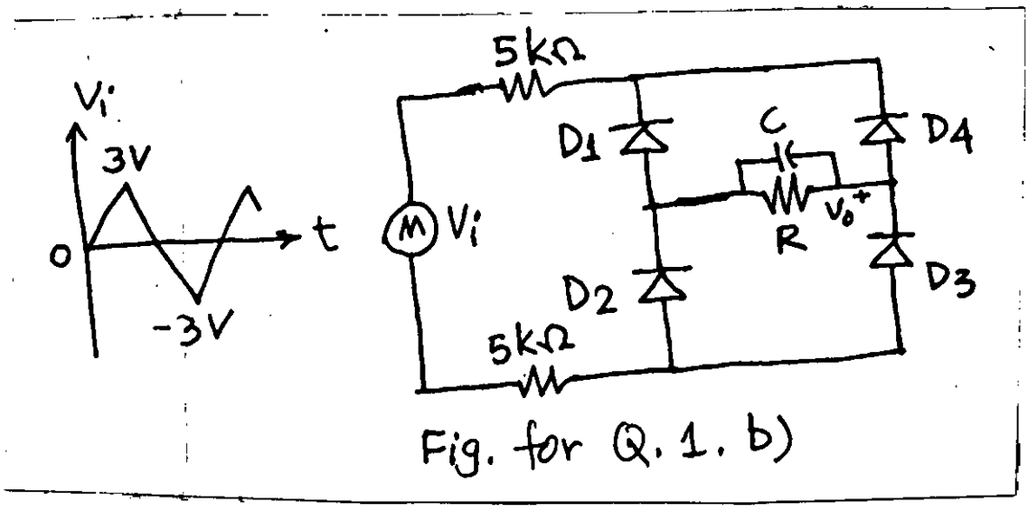

Fig. for Q. 1. b)

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2. (a) Calculate current through R_2 in the circuit shown in Fig. for Q. 2(a). Transistors Q_1 and Q_2 are identical with $V_t = 0.6$ V, $\mu_n C_{ox} = 200\ \mu A/V^2$, $W/L = 10$. Neglect channel length modulation effect and assume appropriate value for missing data if necessary. **(20)**

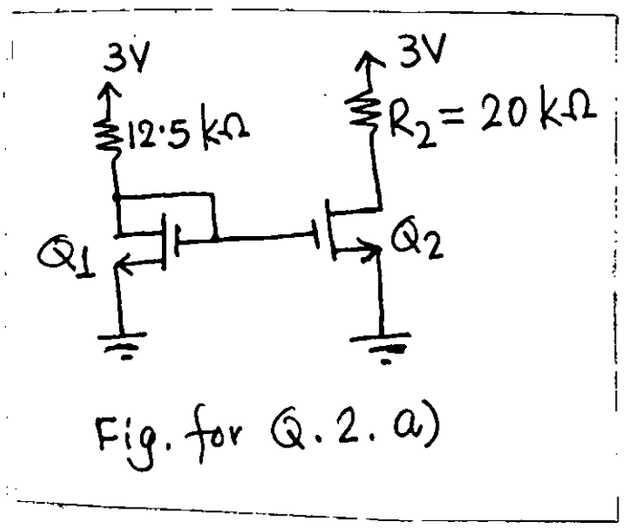

Fig. for Q. 2. a)

(b) Derive an expression for the transconductance (g_m) for small signal operation of MOSFET. **(15)**

3. (a) Explain and sketch the time variation of output voltage, V_o with respect to the given input voltage. v_i in the circuit shown in Fig. for Q. 3(a). Assume ideal diodes. **(20)**

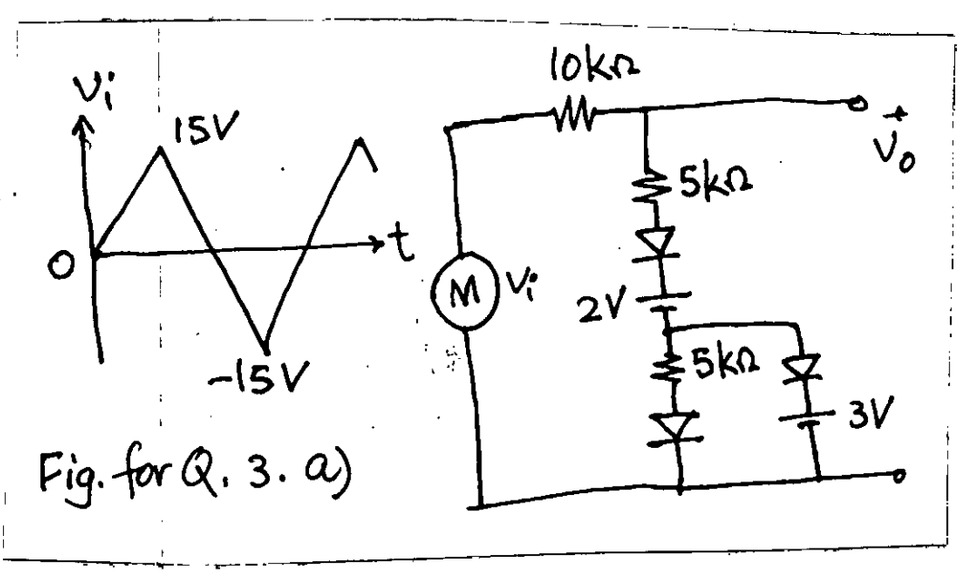

Fig. for Q. 3. a)

(b) Draw a single stage Common Gate Amplifier circuit using p-channel MOSFET and obtain an expression for the voltage gain (Av) through small signal analysis. **(15)**

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4. (a) Explain operation of the circuit shown in Fig. for Q. 4(a) and sketch V_o if v_{in} is a sinusoid with 20 V (peak-to-peak). Make necessary assumptions. **(20)**

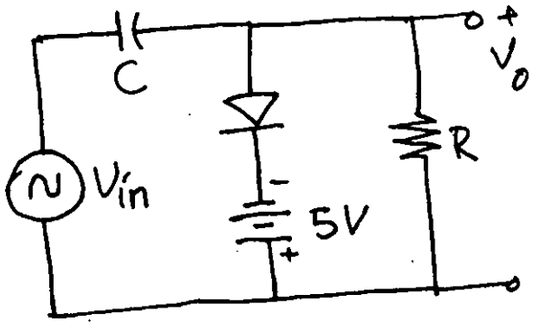

Fig. for Q. 4. a)

(b) Determine the maximum current through R_L in the circuit shown in Fig. for Q. 4(b) for the given input voltage, v_i. Assume ideal diodes. **(15)**

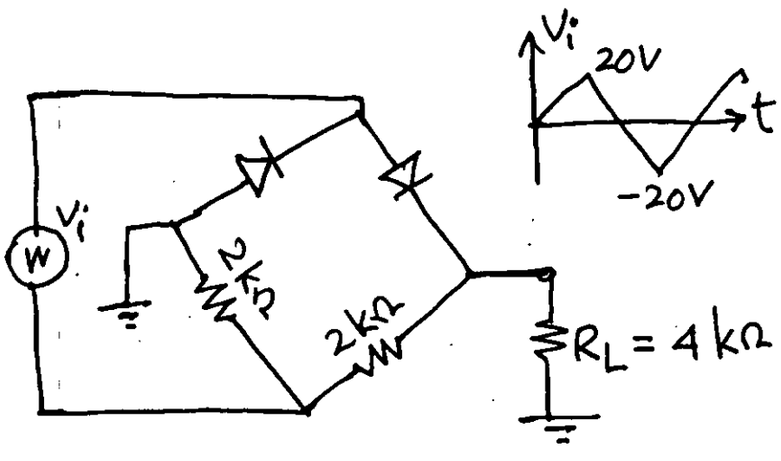

Fig. for Q. 4. b)

SECTION – B

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

5. (a) The full-wave rectifier circuit shown in Fig. for Q. 5(a) has an input signal of frequency 50 Hz. The rms value of V_s = 8.5 V. Assume the diodes to have a forward voltage drop of 0.7 V. (i) What is the maximum value of V_o? (ii) If R = 10 Ω, find the value of C so that the ripple voltage is no larger than 0.25 V. (iii) What must be the PIV rating of each diode? **(18)**

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Contd.... for Q. No. 5(a)

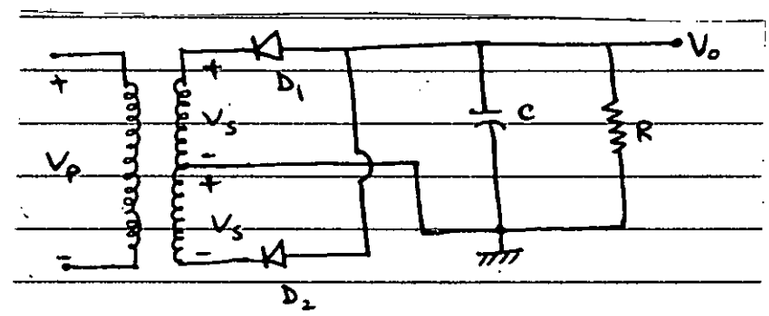

Fig. for Q. 5(a)

(b) Determine the maximum current flowing through the load resistance R_L in the circuit shown in Fig. for Q. 5(b). Plot load current i_L with respect to time(t) for the given input voltage, v_i. **(17)**

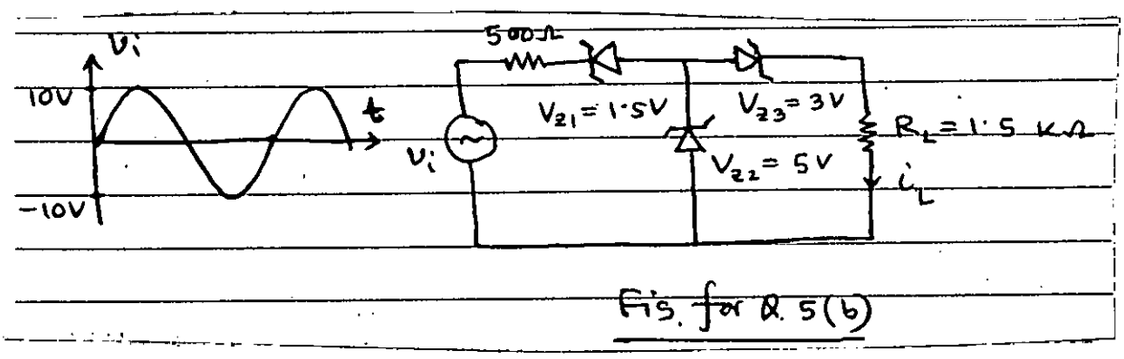

Fig. for Q. 5(b)

6. (a) Find the voltages at all nodes and the currents through all branches in the circuit shown in Fig. for Q. 6(a). Assume $V_{BE}(ON) = 0.7$ V and $\beta = 100$. **(18)**

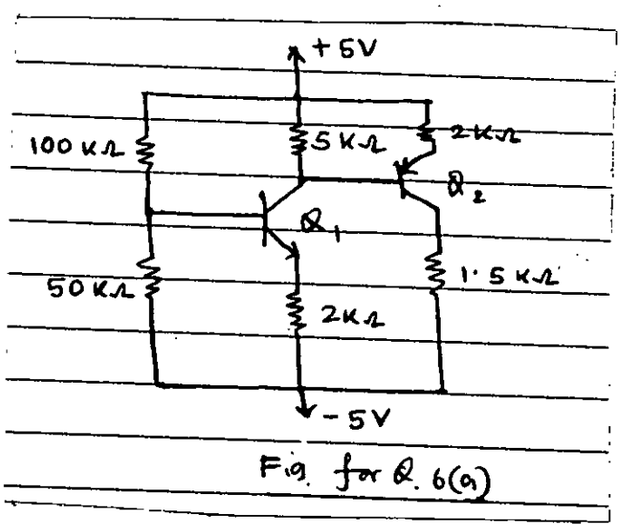

Fig. for Q. 6(a)

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Contd.... for Q. No. 6

(b) Find the value of V_o in the circuit shown in Fig. for 6(b) for (i) I_Q = 0.1 mA and (ii) I_α = 2mA. Assume β = 100 **(17)**

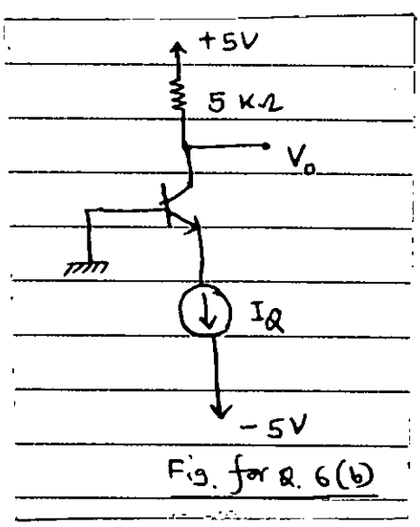

Fig. for Q. 6(b)

7. (a) Derive the small signal model of a BJT and calculate base resistance, emitter resistance and voltage gain. **(15)**

(b) Determine R_{C1}, R_{E1}, R_{C2} and R_{E2} in the circuit shown in Fig. for Q. 7(b) such that I_{C1}=I_{C2}=0.8 mA, V_{ECQ1} = 3.5 V and V_{CEQ2} = 4.0 V. Assume, β = 100 and $V_{BE}(ON)$ = $V_{EB}(ON)$ = 0.7 V. **(20)**

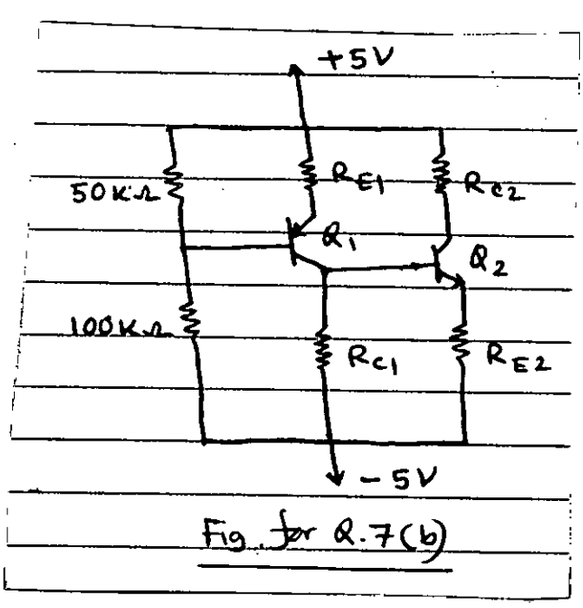

Fig. for Q.7(b)

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8. (a) Find the values of R_{in}, the voltage gain V_o/V_{sig} and the current gain i_o/i_i for the circuit shown in Fig. for Q. 8(a). Assume $\beta = 100$ and $V_A = 100$ V. **(18)**

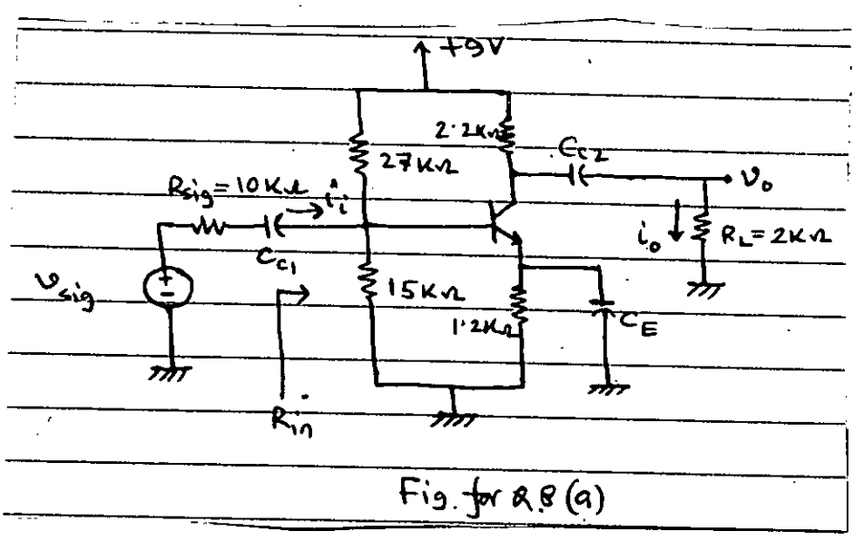

Fig. for Q.8 (a)

(b) The transistor amplifier circuit shown in Fig. for Q. 8(b) is biased with a current source I and has a very high β. Find the dc voltage at the collector, V_c. Replace the transistor with the simplified hybrid-π model and hence find the voltage gain v_c/v_i. **(17)**

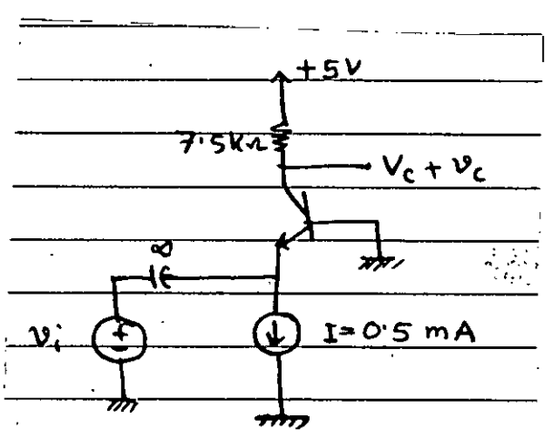

Fig. for Q. 8(b)

L-2/T-1/EEE **Date: 11/04/2023**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2021-2022

Sub: **EEE 203** (Energy Conversion I)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Three 20-kVA 24000/277-V distribution transformers are connected in delta-wye. The open-circuit test was performed on the low-voltage side of this transformer bank, and the short-circuit test was performed on the high-voltage side of this transformer bank. The results of the tests are shown in Table for Q. 1(a) below. **(20)**

Table for Q. 1(a)

Open circuit test	Short circuit test
$V_{line,OC} = 480\ V$	$V_{line,SC} = 1400\ V$
$I_{line,OC} = 4.10\ A$	$I_{line,SC} = 1.80\ A$
$P_{3\phi,OC} = 945\ W$	$P_{3\phi,SC} = 912\ W$

(i) Find the per-unit equivalent circuit of this transformer bank.

(ii) Find the voltage regulation of this transformer bank at the rated load and 0.90 PF lagging.

(iii) What is the transformer bank's efficiency under these conditions mentioned in (ii)?

(b) A 10-kVA 480/120-V conventional transformer is to be used to supply power from a 600-V source to a 120-V load. Consider the transformer to be ideal, and assume that all insulation can handle 600 V. **(15)**

(i) Sketch the transformer connection that will do the required job.

(ii) Find the kVA rating of the transformer in the configuration.

(iii) Find the maximum primary and secondary currents under these conditions.

2. (a) The secondary winding of a transformer has a terminal voltage of $v_s(t) = 282.8\sin(377t)V$. The turns ratio of the transformer is 100:200. If the secondary current of the transformer is $i_s(t) = 7.07\sin(377t - 36.87°)A$, what are its voltage regulation and efficiency? The transformer has been tested and the impedances of this transformer referred to the primary side are shown in Table for Q.2(a) below. **(20)**

Table for Q. 2(a)

$R_{eq} = 0.2\ \Omega$
$X_{eq} = 0.80\ \Omega$
$R_C = 300\ \Omega$
$X_m = 100\ \Omega$

(b) With necessary diagrams and illustrations, explain the magnetization current and core loss current in transformers. With these, rationalize the different components of the exact equivalent circuit of a transformer. **(15)**

Contd P/2

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3. (a) Consider a simple power system consisting of an ideal voltage source, an ideal step-up transformer, a transmission line, an ideal step-down transformer, and a load. The voltage of the source is $V_S = 480\angle 0°V$. The impedance of the transmission line is $Z_{line} = 3 + j4\,\Omega$, and the impedance of the load is $Z_{load} = 30 + j40\,\Omega$. Assume that the step-up transformer (XFR1) has a turns ratio of 1:5 and the step-down transformer (XFR2) has a turns ratio of 5:1. (i) What is the efficiency of the system? (ii) What transformer turns ratio is needed so that the transmission line losses are 1% of the total power produced by the generator? **(20)**

(b)With necessary equations briefly describe the apparent power rating advantage of autotransformers. Additionally, show that, if a transformer having a series impedance Z_{eq} is connected as an autotransformer, its per-unit series impedance Z'_{eq} as an autotransformer will be given by $Z'_{eq} = \dfrac{N_{SE}}{N_{SE} + N_C} Z_{eq}$. **(15)**

4. (a) A 100-MVA 230/115-kV delta-wye three-phase power transformer has resistance of 0.015 pu and reactance of 0.06 pu. The excitation branch elements are R_C = 100 pu, and X_m = 20 pu. **(20)**

   (i) If this transformer supplies a load of 80 MVA at 0.8 PF lagging, draw the phasor diagram of one phase of the transformer.

   (ii) What is the voltage regulation of the transformer bank under these conditions?

   (iii) Sketch the equivalent circuit referred to the low-voltage side of one phase of this transformer.

   (iv) Calculate the efficiency of the transformer under the conditions of part(i).

   (b) Show that in an open-delta connection 86.6% of the rating of the two remaining transformers can be used. **(15)**

SECTION – B

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

Symbols have their usual meaning.

5. (a) Prove that a three-phase set of voltages applied to the stator of a three phase induction motor produces a rotating magnetic field. What is the speed of the magnetic field's rotation? **(12)**

   (b) Make a comparison between a wound rotor and a cage rotor induction motor. **(7)**

Contd P/3

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Contd.... for Q. No. 5

(c) A 208-V, 10-hp, four-pole, 60-Hz, Y-connected induction motor has a full-load slip of 5 percent. **(16)**

(i) What is the synchronous speed of this motor?

(ii) What is the rotor speed of this motor at the rated load?

(iii) What is the rotor voltage frequency of this motor at the rated load?

(iv) What is the shaft torque of this motor at the rated load?

6. (a) Discuss why wound-rotor induction generator is used in wind power generation. **(10)**

(b) The value magnetizing reactance of an induction motor is much smaller than that of an ordinary transformer— Why? **(7)**

(c)A 3-phase, 230-V, 60-Hz, 100-hp, six-pole induction motor has an efficiency of 91% (at rated conditions) and draws a line current of 248 A. Its core loss, stator cu loss, and rotor cu loss are 1697 W, 2803 W, and 1549 W, respectively. Find its (i) input power (ii) total loss, (iii) air gap power, (iv) shaft speed, (v) power factor, (vi) P_{fw} and P_{stray} combined, (vii) shaft torque. **(18)**

7. (a) Suppose you have three types of relays (TD0, TD1 and TD2). TD0 closes the contacts instantly after energizing, TD1 closes the contacts 1s after energizing and TD2 closes the contacts 2s after energizing. Using these relays, design a three-step resistive starting circuit of a three phase induction motor. One third of the resistance should be removed after 3s from staring, another one third should be removed after 5s from starting and the last one third of the resistance should be removed after 6s from starting. You can use multiple relays of the same type. Your starting circuit should also protect the motor from short circuit, overload and under-voltage conditions. **(17)**

(b) The following test data were taken on a 7-hp, four-pole, 415-V, 50-Hz, design class A, Y-connected induction motor having a rated current of 24 A. **(18)**

DC test: $V_{DC} = 18$

No-load test: $I_L = 7$ A, $P_{in} = 400$ W

Locked-rotor test: $V_T = 30$ V, $f = 15$ Hz, $P_{in} = 850$ W.

Determine the equivalent circuit model parameters and sketch the per-phase equivalent circuit for this motor. Given that $X_1 = X_2$ for design class A motors.

8. (a) Derive the expression of the induced torque in terms of the equivalent circuit model parameters of an induction motor. Then derive the expression of the pullout torque. **(10)**

(b) How does the torque-speed characteristics of a three-phase induction motor vary with line frequency? Explain with necessary equations. **(10)**

(c) A 208-V, 7.5-hp, 60-Hz, four-pole, Y-connected wound-rotor induction motor has the following impedances in ohms per phase referred to the stator circuit: **(15)**

$R_1 = 0.243\ \Omega$, $X_1 = 0.67\ \Omega$, $R_2 = 0.151\ \Omega$, $X_2 = 0.67\ \Omega$, $X_M = 14.03\ \Omega$

(i) What is the maximum torque of this motor? At what speed does it occur?

(ii) What is the starting torque of this motor?

L-2/T-1/EEE **Date: 28/03/2023**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2021-2022

Sub: **EEE 211** (Continuous Signals and Linear Systems)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

The symbols have their usual meanings.

1. (a) Is the following signal periodic? If so, what is the period? **(10)**

$$x(t)=\sqrt{e^{j5\pi t}}+\sin^2\left(3t-\frac{\pi}{4}\right)$$

(b) Determine whether the signal $e^{-3t}\sin\left(\frac{2\pi}{3}t-4\right)u(t)$ is a power or an energy signal.

Justify your answer. **(10)**

(c) Give a signal $x(t)=\delta(t-1)+u(t)u(t-3)+u(\cos t)$ **(15)**

Compute $y(t)=\int_{-\alpha}^{t}x(\tau)d\tau$ and sketch $y(1/2)$.

2. (a) The input $x(t)$ and the impulse response of an LTI system is shown in Fig. for Q. 2(a). Compute the output $y(t)$ using the graphical method. Also, write the analytical expression of $y(t)$. **(17)**

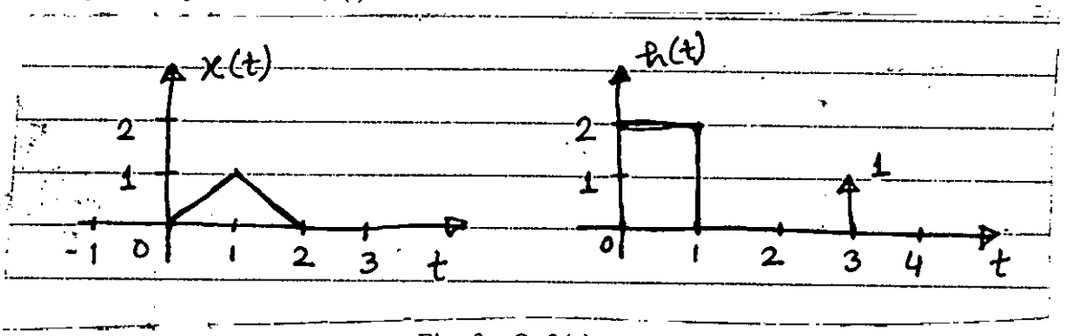
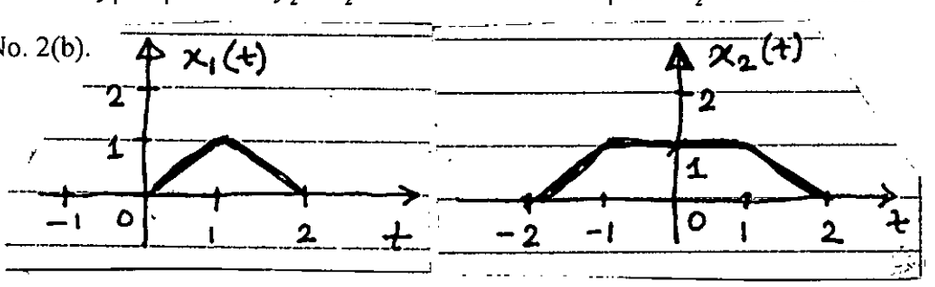


Fig. for Q. 2(a)

(b) Let h be the impulse response of an LTI system, and let x_1, x_2, y_1, y_2 denote functions such that $y_1 = x_1 * h$ and $y_2 = x_2 * h$. The functions x_1 and x_2 are shown in Fig. for Q. No. 2(b). **(18)**



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3. (a) Let $x(t)$ be a periodic signal with a period of T = 4. The signal in one period can be written as $x_T(t) = \delta(t-1) + 2[u(t-2) - u(t-4)]$ $0 \le + \le 4$. The signal is applied to the circuit shown in Fig. for Q. 3(a). Plot the magnitude and phase spectra of input $x(t)$ and output $y(t)$. **(20)**

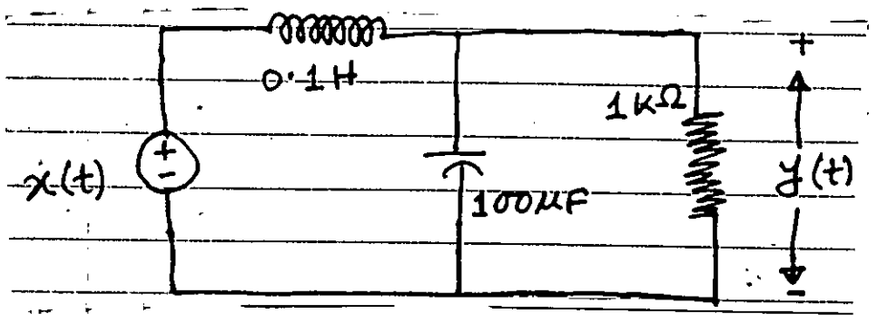

Fig. for Q. 3(a)

(b) Show that three functions as shown in Fig. for Q. 3(b) are pair-wise orthogonal over the interval (–2, 2). How can you make these functions as an orthonormal set? Express the function $x(t)$ in terms of the orthonormal set, where, **(15)**

$$x(t) = \begin{cases} 1. & \text{for} \quad 0 \le t \le 2 \\ 0, & \text{otherwise} \end{cases}$$

Validate the Perseval's relation in this case.

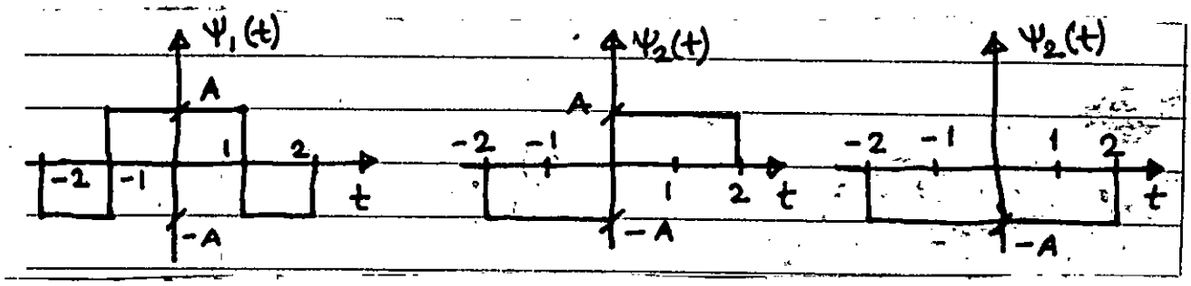

Fig. for Q. 3(b)

4. An LTI system is described by the following input-output relation: **(35)**

$$y''(t) + 7y'(t) - 12y(t) = x''(t) + 3x'(t) + 4x(t); \quad y'(0) = -2, \; y(0) = 0$$

(i) Draw the simulation diagram of the system in second canonical form.

(ii) Write the state equation of the system.

(iii) Find the state transition matrix, and hence evaluate the $h(t)$ of the system.

(iv) Comment on the stability of the system, and evaluate the unit-step response of the system.

(v) Evaluate the matrix that will transform the state equation of the second canonical form to the first canonical form.

You can use Laplace transform as and when required.

Contd P/3

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SECTION – B

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

5. (a) The Fourier series representation of a periodic signal $\tilde{x}(t)$ is given by **(18)**

$$\tilde{x}(t) = \sum_{n=-\infty}^{\infty} C_n e^{jnw_o t}$$

What does happen if the waveform, $\tilde{x}(t)$, is kept unchanged but the period T is increased? Show mathematically that in the limit as $T \to \infty$, we can write one period of $\tilde{x}(t)$ as

$$x(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} X(w) e^{jwt}\, dw$$

(b) Determine the time-domain signal $x(t)$ that has the Fourier transform $X(w)$, as shown in Fig. for Q. 5(b) **(17)**

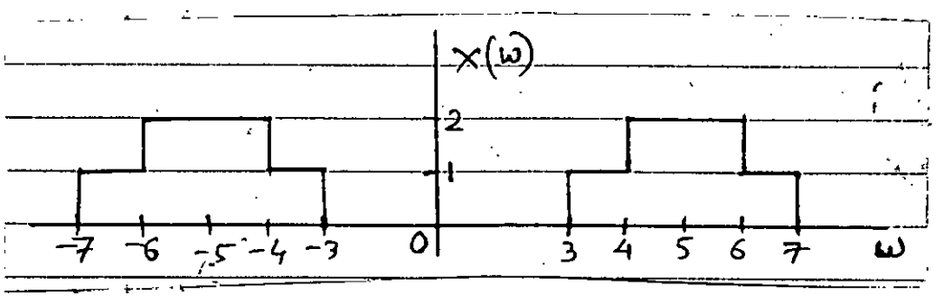

Fig. for Q. 5(b)

6. (a) An analog bandbass signal $x_a(t)$ is given as input to the system as shown in Fig. for Q. 6(a). **(20)**

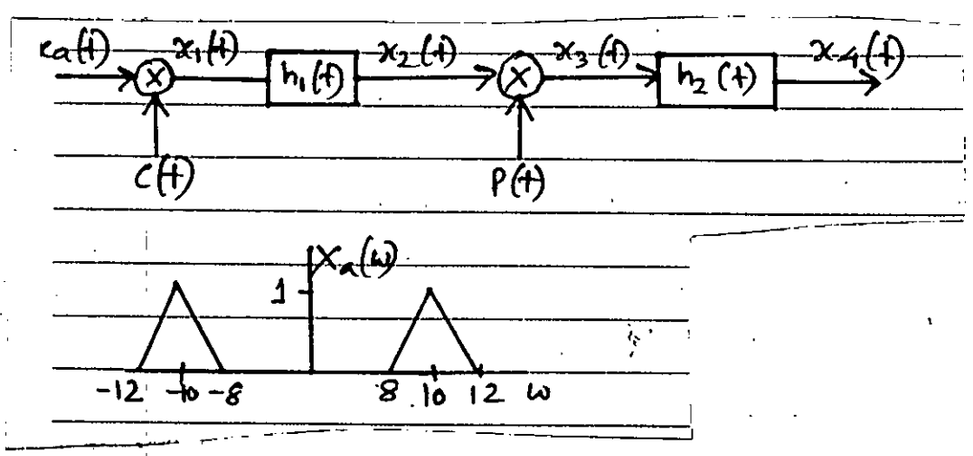

Fig. for Q. 6(a)

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Contd.... for Q. 6(a)

Here, $c(t)=\cos(10t)$

$$h_1(t)=\frac{\sin(2t)}{\pi t}$$

$$p(t)=\sum_{n=-\infty}^{\infty}\delta\left(t-\frac{2\pi n}{5}\right)$$

$$h_2(t)=2\frac{\sin(2t)}{\pi t}\cos(10t)$$

Sketch the spectra of the signals $x_1(t), x_2(t), x_3(t)$ and $x_4(t)$.

(b) Consider a non-causal LTI system with the impulse response $h(t)=e^{2t}u(-t)$. **(15)**

(i) Determine the 3-dB bandwidth of the system,

(ii) Determine the duration of the impulse response, at which $h(t)$ drops to $\frac{1}{e}$ of its value at $t = 0$.

(iii) Determine the duration-bandwidth product of the system.

7. (a) Determine the Laplace transform and sketch the ROC of each of the following signals: **(12)**

(i) $e^{-at}u(t), a>0$

(ii) $e^{-at}u(t), a<0$, and

(iii) $-e^{-at}u(-t), a<0$.

(b) use convolute property to find the time-domain signal corresponding to the Laplace transform **(12)**

$$X(s)=\frac{1}{(s-a)^3}$$

(c) Solve the differential equation using the Laplace transform: **(11)**

$$y'(t)+2y(t)=e^{-3t}u(t),\quad y(0^-)=1$$

8. (a) Consider a control system shown in Fig. for Q. 8(a). here, the input to the system is the reference signal $r(t)$, and $w(t)$ is introduced to model any disturbance in the system. **(18)**

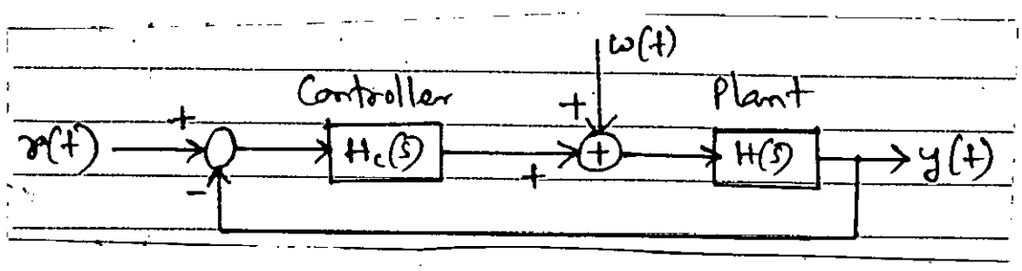

Fig. for Q. 8(a)

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Contd.... for Q. No. 8(a)

(i) Determine the transfer function of the system, $H_d(s) = \frac{Y(s)}{W(s)}$, with respect to the disturbance signal.

(ii) Show that the output of the system for a unit step-disturbance will be zero at steady-state condition, if the controller $H_c(s)$ has a zero at $s = 0$.

(b) Draw the force-voltage analogous electrical circuit and write the equation of motion in term of the given mechanical quantities of the system shown in Fig. for Q. 8(b). **(17)**

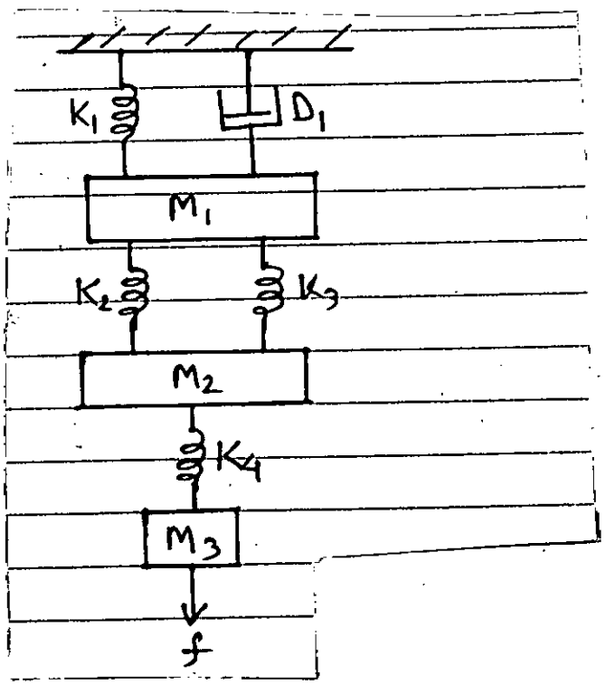

Fig. for Q. 8(b)

L-2/T-1/EEE **Date: 30/04/2023**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2021-2022

Sub: **HUM 135** (English)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Explain with reference to the context any **TWO** of the following: **(15)**

   (i) "I was young and ill-educated and I had had to think out my problems in the utter silence that is imposed on every Englishman in the East."

   (ii) "My God, Hester, you're eighty thousand pounds to the good, and a poor son to the bad," he said. "But, poor, poor boy, he's best gone out of a life where he rides his rocking-horse to find a winner."

   (iii) "This is our island. It's a good island. Until the grown-ups come to fetch us we'll have fun."

   (b) Answer any **ONE** of the following: **(15)**

   (i) How did Orwell depict the moral dilemmas of a Englishman in the East in his short story "Shooting an Elephant"?

   (ii) Compare and contrast the characters of Jack and Ralph in "Fire on the Mountain".

   (c) Answer any **THREE** of the following: **(15)**

   (i) What is your opinion about Paul's mother?

   (ii) What does the rocking horse signify in "The Rocking Horse Winner"?

   (iii) Describe the appearance of the Astrologer.

   (iv) Why did Orwell use the Latin phrase *in saecula saeculorum* in "Shooting an Elephant"?

   (v) What is the significance of the "Conch" in "Fire on the Mountain"?

2. (a) Recast and correct any **TEN** of the following sentences: **(15)**

   (i) Richard came in the room and sat down.

   (ii) I bought a book at fifty pence.

   (iii) Divide the apple between you three.

   (iv) You must guard from bad habits.

   (v) They're indifferent for politics.

   (vi) John's popular among his friends.

   (vii) I have other books except these.

   (viii) Not many figs have stayed on the tree.

   (ix) Philip was angry and tore the letter.

   (x) Who do you think I saw yesterday?

   (xi) Lessons begin at eight and a half.

   (xii) These flowers grow up very quickly.

Contd P/2

HUM 135/EEE

Contd.... for Q. No. 2

(b) Give the meanings of and make sentences with any **TEN** of the following words: **(15)**

Benevolent, Cajole, Despicable, Emissary, Formidable, Gullible, Limerick, Misnomer, Litter, Furtive, Eschew, Penchant.

3. Amplify any **ONE** of the following: **(30)**

(i) "An eye for an eye will only make the whole world blink."

(ii) "It is not in the stars to hold our destiny but in ourselves."

4. Write a précis of the following passage with a suitable title: **(30)**

Animals have been used for experiments throughout the history of biomedical research. In recent years, the practice of using animals for research has come under severe criticism by animal protection and animal rights groups. Laws have been passed in several countries to make the practice more 'humane'. Debates on the ethics of animal testing have raged for many years. It is often said that animal testing should be banned because it is cruel and unnecessary. Those in favor of animal testing argue that experiments on animals are necessary to advance medical and biological knowledge. For instance, many famous lifesaving drugs were invented in this way, and animal experiments may help us to find more cures in the future. Even a cure for cancer and AIDS can be found through it in near future. Furthermore, the animals which are used are not usually wild but are bred especially for experiments. So, they believe it is not true that animal experiments are responsible for reducing the number of wild animals on the planet. On the contrary, those against, contend that the benefit to humans does not justify the harm to animals. First and foremost, animal experiments are unkind and cause animals a lot of pain. In addition, they feel that many tests are not important. In fact, animals are not only used to test new medicines but also new cosmetics. Another issue is that sometimes an experiment on animals gives us the wrong result because animals' bodies are not the same as our own. As a consequence, this testing may not be providing the safety that its proponents claim. There are many alternatives to animal testing, which is one logical reason for banning this practice. Tissue culture methods, for example, can be used as alternatives to animal testing. Monoclonal antibodies can be created with the help of cultured cells. Tissue engineering techniques can be used for culturing these cells. It is also possible to make a model of the human immune system to check whether a particular vaccine is effective or not. The benefits of animal testing do not outweigh the disadvantages, therefore, testing on animals should not be continued. Although it may improve the lives of humans, it is not fair that animals should suffer to achieve this. Making use of alternatives to animal experimentation is surely a better choice.

Contd P/3

SECTION – B

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

5. Read the following passage carefully and answer the questions that follow. **(45)**

During the first year of a child's life, parents and carers are concerned with its physical development: during the second year, they watch the baby's language development very carefully. It is interesting just how easily children learn language. Children who are just three or four years old, who cannot yet tie their shoelaces, are able to speak in full sentences without any specific language training. The current view of child language development is that it is an instinct - something as natural as eating or sleeping. According to experts in this area, this language instinct is innate - something each of us is born with. But this prevailing view has not always enjoyed widespread acceptance.

In the middle of last century, experts of the time, including a renowned professor at Harvard University in the United States, regarded child language development as the process of learning through mere repetition. Language "habits" developed as young children were rewarded for repeating language correctly and ignored or punished when they used incorrect forms of language. Over time, a child, according to this theory, would learn language much like a dog might learn to behave properly through training. Yet even though the modern view holds that language is instinctive, experts like Assistant Professor Lise Eliot are convinced that the interaction a child has with its parents and caregivers is crucial to its developments. The language of the parents and caregivers act as models for the developing child. In fact, a baby's day-to-day experience is so important that the child will learn to speak in a manner very similar to the model speakers it hears. Given that the models parents provide are so important, it is interesting to consider the role of "baby talk" in the child's language development. Baby talk is the language produced by an adult speaker who is trying to exaggerate certain aspects of the language to capture the attention of a young baby.

Dr Roberta Golinkoff believes that babies benefit from baby talk. Experiments show that immediately after birth babies respond more to infant-directed talk than they do to adult-directed talk. When using baby talk, people exaggerate their facial expressions, which helps the baby to begin to understand what is being communicated. She also notes that the exaggerated nature and repetition of baby talk helps infants to learn the difference between sounds. Since babies have a great deal of information to process, baby talk helps. Although there is concern that baby talk may persist too long, Dr Golinkoff says that it stops being used as the child gets older, that is, when the child is better able to communicate with the parents.

Contd P/4

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Contd.... for Q. No. 5

Professor Jusczyk has made a particular study of babies' ability to recognise sounds, and says they recognise the sound of their own names as early as four and a half months. Babies know the meaning of Mummy and Daddy by about six months, which is earlier than was previously believed. By about nine months, babies begin recognizing frequent patterns in language. A baby will listen longer to the sounds that occur frequently, so it is good to frequently call the infant by its name. An experiment at Johns Hopkins University in USA, in which researchers went to the homes of 16 nine-month-olds, confirms this view. The researchers arranged their visits for ten days out of a two-week period. During each visit the researcher played an audio tape that included the same three stories. The stories included odd words such as "python" or "hornbill", words that were unlikely to be encountered in the babies' every experience. After a couple of weeks during which nothing was done, the babies were brought to the research lab, where they listened to two recorded lists of words. The first list included words heard in the story. The second included similar words, but not the exact ones that were used in the stories.

Jusczyk found the babies listened longer to the words that had appeared in the stories, which indicated that the babies had extracted individual words from the story. When a control group of 16 nine-month-olds, who had not heard the stories, listened to the two groups of words, they showed no preference for either list. This does not mean that the babies actually understand the meanings of the words, just the sound patterns. It supports the idea that people are born to speak, and have the capacity to learn language from they day they are born. This ability is enhanced if they are involved in conversation. And, significantly, Dr Eliot reminds parents that babies and toddlers need to feel they are communicating. Clearly, sitting in front of the television is not enough; they baby must be having an interaction with another speaker.

Questions:

(a) Comment on the current view of child language learning.

(b) Explain the role of interactions in child language development.

(c) Analyse Dr Roberta Golinkoff's ideas of baby talk.

(d) What were the findings in Professor Jusczyk's research?

(e) Give an appropriate title to the passage and justify it.

(f) Give the meanings of the following words as used in the passage.

Instinctive, exaggerate, prevailing, widespread, encounter

Contd P/5

6. (a) Briefly discuss different types of tenders. **(10)**

(b) Suppose you bought two lifts from Xeobi Lift Ltd. The company agreed to provide regular and reliable after-sales services. However, you are not satisfied with their after-sales services. Now, write a complaint letter to the Managing Director of Xeobi Lift Ltd. (Full Block) **(10)**

(c) Write phonetic transcription of any five of the following words. **(10)**

Donate, ring, healthy, bank, swift, baby

7. (a) Briefly discuss the main body elements of a report. **(10)**

(b) Write a short essay on any one of the following topics. **(10)**

(i) The Worsening Air Quality in Dhaka

(ii) The Importance of Dreaming Big

(iii) Culture Shocks

(c) Write a dialogue between you and your friend about the significance of digital literacy. **(10)**

8. (a) Transform any five of the following sentences as directed. **(10)**

(i) It is so late that we cannot start a new lesson. (Simple)

(ii) By wasting your time, you can spoil your life. (Compound)

(iii) When I went there, I found him absent. (Simple)

(iv) He ran to the station but could not catch the train. (Complex)

(v) Can wealth buy health? (Assertive)

(vi) The writer of this book was a doctor. (Complex)

(b) Briefly discuss the contents of a job application. **(5)**

(c) Write short notes on any three of the following. **(15)**

(i) Business communication

(ii) Topic sentence

(iii) Connotation and denotation

(vi) Routine reports.

L-2/T-1/EEE **Date: 04/04/2023**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2021-2022

Sub: **MATH 259** (Linear Algebra)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

Symbols used have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Solve the system of homogeneous equations **(18)**

$$\begin{aligned} 2x+2y+4z&=0\\ -2x-2y-z&=0\\ 2w+3x+y+z&=0\\ -2w+x+3y-2z&=0 \end{aligned}$$

by reducing the coefficient matrix to its reduced row echelon form.

(b) Determine the values of 'a' for which the system **(17)**

$$\begin{aligned} x+2y+z&=2\\ 2x-2y+3z&=1\\ x+2y-(a^2-3)z&=a \end{aligned}$$

have no solutions, unique solution, or infinitely many solutions

2. (a) If $A=\begin{bmatrix}0 & 0 & -2\\ 1 & 2 & 1\\ 1 & 0 & 3\end{bmatrix}$, then find the eigenspaces of A. **(18)**

(b) Determine whether the following matrix is diagonalizable. If so, find a nonsingular matrix P that diagonalizes A, and write down the diagonal matrix D so that $P^{-1}AP = D$, where **(17)**

$$A=\begin{bmatrix}5 & 4 & -1\\ 4 & 5 & -1\\ -4 & -4 & 2\end{bmatrix}.$$

3. (a) Find non-singular matrices P and Q such that PAQ is in the normal form, where **(17)**

$$A=\begin{bmatrix}3 & 2 & -1 & 5\\ 5 & 1 & 4 & -2\\ 1 & -4 & 11 & -19\end{bmatrix}.$$

Contd P/2

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Contd.... for Q. No. 3

(b) Reduce the matrix $A = \begin{bmatrix} 2 & 7 & 3 & 5 \\ 1 & 2 & 3 & 4 \\ 3 & 8 & 1 & -2 \\ 4 & 13 & 1 & -1 \end{bmatrix}$ to echelon form then to its canonical form and write down the rank and nullity. Also verify the Dimension theorem. **(18)**

4. (a) Verify Cayley - Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$. Hence find A^{-1}. **(10)**

(b) Write down the symmetric matrix A corresponding to the quadratic form $q = X'AX = x^2 + 7y^2 + 8z^2 - 6xy + 4xz - 10yz$. Then find nonsingular matrix P such that $P^tAP = D$ (a diagonal matrix). Write down the rank, index and signature. Identify the geometrical object represented by q = constant. **(25)**

SECTION – B

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

5. (a) Derive the standard matrix for the stated composition in $\Re^3$: A rotation of $-30°$ about the x-axis, followed by a contraction with factor $\frac{1}{4}$, followed by a reflection about the yz-plane, followed by an orthogonal projection on the xz-plane. Also, find the image of the triangle with vertices $(-1,0,-3)$, $(2,-2,-3)$, $(-1,-2,3)$ with respect to the stated composition of linear operators in $\Re^3$. **(18)**

(b) Determine whether the matrix operator $T : \Re^3 \to \Re^3$ defined by the following equations is one-to-one; if so, find the standard matrix for the inverse operator, and find $T^{-1}(w_1, w_2, w_3)$. **(17)**

$$w_1 = x_1 - 2x_2 + 2x_3$$
$$w_2 = 2x_1 + x_2 + x_3$$
$$w_3 = x_1 + x_2$$

6. (a) Find a subset of the vectors $\mathbf{v}_1 = (1, -1, 5, 2)$, $\mathbf{v}_2 = (-2, 3, 1, 0)$, $\mathbf{v}_3 = (4, -5, 9, 4)$, $\mathbf{v}_4 = (0, 4, 2, -3)$, $\mathbf{v}_5 = (-7, 18, 2, -8)$ that forms a basis for the space spanned by those vectors, and then express each vector that is not in the basis as a linear combination of the basis vectors. Also find their co-ordinate vectors with respect to that basis. **(17)**

(b) Consider the bases $B_1 = \{\mathbf{u}_1, \mathbf{u}_2\}$ and $B_2 = \{\mathbf{v}_1, \mathbf{v}_2\}$ **(18)**

where $\mathbf{u}_1 = (1, 2)$, $\mathbf{u}_2 = (2, 3)$, $\mathbf{v}_1 = (1, 3)$ and $\mathbf{v}_2 = (1, 4)$.

(i) Find the transition matrix $P_{B_2 \to B_1}$ from B_2 to B_1.

(ii) Find the transition matrix $P_{B_1 \to B_2}$ from B_1 to B_2.

(iii) Let $\mathbf{w} = (2, 5)$. Find $[\mathbf{w}]_{B_2}$ and then use the matrix $P_{B_2 \to B_1}$ to compute $[\mathbf{w}]_{B_1}$ from $[\mathbf{w}]_{B_2}$.

Contd P/3

MATH 259(EEE)

7. (a) Find a basis for the orthogonal complement of the subspace of $\mathcal{R}^5$ spanned by the vectors $\mathbf{v}_1 = (1, 4, 5, 6, 9)$, $\mathbf{v}_2 = (3, -2, 1, 4, -1)$, $\mathbf{v}_3 = (-1, 0, -1, -2, -1)$, $\mathbf{v}_4 = (2, 3, 5, 7, 8)$. **(17)**

(b) Describe the Gram-Schmidt process. Let $\mathcal{R}^4$ has the Euclidean inner product. Use the Gram-Schmidt process to transform the basis $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3, \mathbf{u}_4\}$ into an orthonormal basis, where $\mathbf{u}_1 = (0, 2, 1, 0)$, $\mathbf{u}_2 = (1, -1, 0, 0)$, $\mathbf{u}_3 = (1, 2, 0, -1)$, $\mathbf{u}_4 = (1, 0, 0, 1)$. **(18)**

8. (a) Determine whether the function $T : M_{33} \to R$ defined by $T(A) = del\ A$ is a linear transformation or not, justify your answer with an example. **(10)**

(b) Consider the basis $S = \{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ for $\mathcal{R}^3$, where $\mathbf{v}_1 = (1, 1, 1)$, $\mathbf{v}_2 = (1, 1, 0)$, and $\mathbf{v}_3 = (1, 0, 0)$, and let $T : \Re^3 \to \Re^3$ be the linear operator for which $T(\mathbf{v}_1) = (2, -1, 4)$, $T(\mathbf{v}_2) = (3, 0, 1)$, $T(\mathbf{v}_3) = (-1, 5, 1)$. Find a formula for $T(x_1, x_2 x_3)$, and use that formula to find $T(2, 4, -1)$. Also find a basis for the **(25)**

(i) Kernel of T.

(ii) Range of T.
