L-2/T-1/EEE **Date: 20/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2016-2017

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

Full Marks: 210 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

The questions are of equal value.

1. (a) Describe with necessary diagrams the constructional details of stator and rotor of three phase squirrel cage and wound rotor induction motors. By using necessary formulae and relevant diagrams explain how induced torque of 3-phase induction motor is developed. What is the load angle δ of the motor and what is its relation to the rotor power factor angle θ_R?

   (b) A 460 V, 60 Hz, 4-pole, Y-connected three-phase induction motor has the equivalent circuit parameters as follows:

   $R_1 = 0.641\ \Omega$, $R_2 = 0.332\ \Omega$, $X_M = 26.3\ \Omega$, $X_1 = 1.106\ \Omega$, $X_2 = 0.464\ \Omega$

   (Symbols have their usual meaning)

   The total rotational losses are 1100 W and is constant. For a rotor slip of 2.2% at the rated voltage and rated frequency, find the motor's stator current, power factor, converted power, output power and the load torque.

2. (a) Draw and explain the power flow diagram of a three-phase induction motor. By using the per phase equivalent circuit of the motor find the formulae for stator copper loss, core loss, air-gap power, rotor copper loss, converted mechanical power, induced torque and load torque of the motor.

   (b) Explain the classes A, B, C, D of three-phase induction motor. By drawing the torque-slip characteristics of these motors explain the differences in performance of them. Mention the areas of application of these motors.

3. (a) By using the equivalent circuit of a three-phase induction motor and applying to it the Thevenin's theorem derive the expression of induced torque of the motor. From this expression explain the shape of Torque-Slip characteristic of the induction motor.

   (b) A 440 V, 50 Hz, 2-pole, Y-connected three-phase induction motor has the equivalent circuit parameters as follows:

   $R_1 = 0.075\ \Omega$, $R_2 = 0.065\ \Omega$, $X_M = 7.2\ \Omega$, $X_1 = 0.17\ \Omega$, $X_2 = 0.17\ \Omega$,

   $P_{F\&W} = 1.0$ kW, $P_{misc} = 150$ W, $P_{core} = 1.1$ kW

   For a slip of 0.04, find the line current and its power factor, the air-gap power, the output load power and the load torque.

Contd P/2

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4. (a) Derive the per phase equivalent circuit of a three-phase induction motor. Draw this equivalent circuit with rotor losses and converted power separated.

(b) A 50 kW, 440 V, 50 Hz, 6-pole three-phase induction motor has a slip of 0.06 when operating at full load condition. At full load the friction and windage losses are 300 W and core losses are 600 W. Find the following values at full load:

(i) The shaft speed,

(ii) The output power in Watts,

(iii) The load torque,

(iv) The induced torque,

(v) The rotor frequency.

SECTION-B

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

The figures in the margin indicate full marks.

5. (a) With neat diagram and necessary equations/vectors, explain the phenomenon of transfer of ac power from primary to secondary side of an electric transformer. **(20)**

(b) A single phase transformer has the following equivalent circuit (Fig. 5(b)) and delivers power to a lamp load. **(15)**

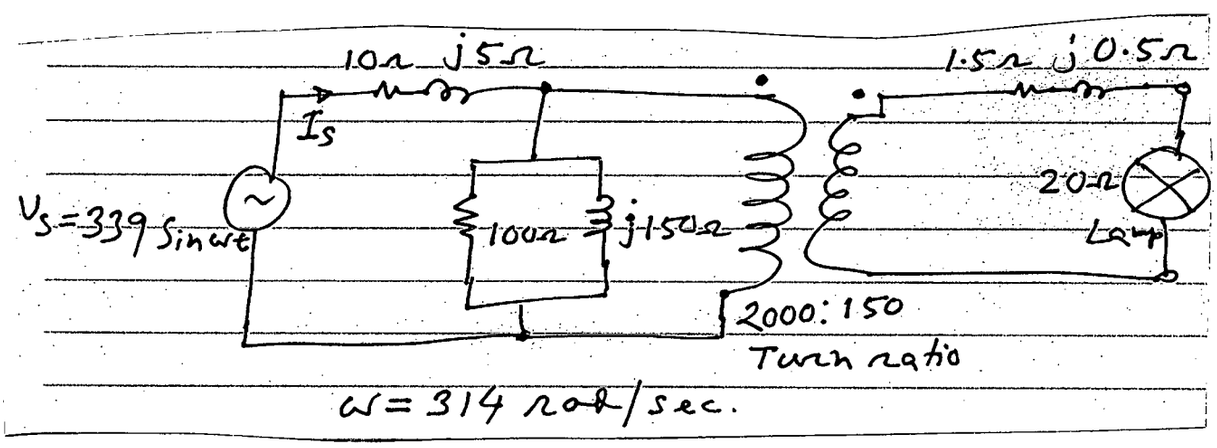

Fig. for Q 5(b)

Determine the supply side current Is in amps.

6. (a) Explain why transformers are rated in volt-ampere (i.e., VA, KVA, MVA). **(5)**

(b) With a neat diagram, explain why the magnetizing (no-load) current of a transformer is non--sinusoidal even though the transformer is supplied from a sinusoidal voltage source. **(15)**

Contd P/3

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Contd... Q. No. 6

(c) What is percentage impedance of a transformer? **(15)**

A single phase 50 KVA, $11/\sqrt{3}$ KV/240 V ac, 50 Hz transformer has a percentage impedance of 4%.

Determine the voltage regulation of the transformer at rated load current at

(i) 0.8 P.F. lagging

(ii) 0.8 P.F. leading

(iii) Unity P.F.

Neglect all loss of the transformer.

7. (a) A single phase transformer has three windings rated 240V, 24V and 12V and their polarities are according to as shown in Fig. 7(a). **(15)**

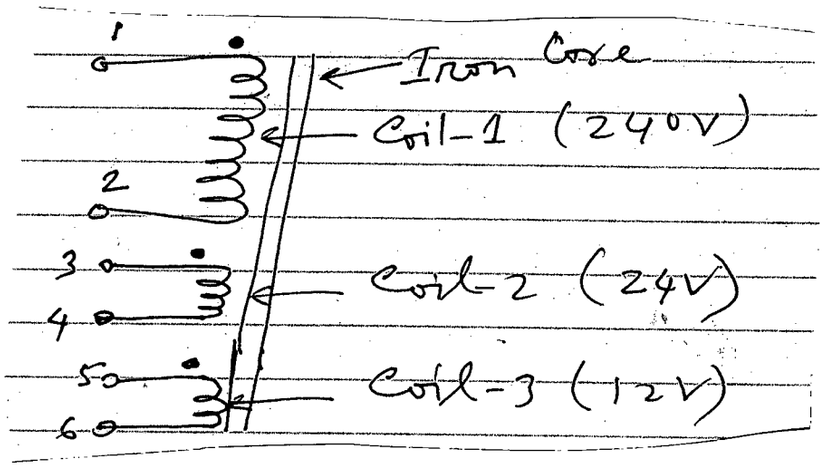

Fig. for Q 7(a)

The current rating of 240 V coil is 10 A.

Connect the coils so that the transformer can have its maximum VA rating and then

(i) determine the VA rating of the transformer,

(ii) appropriate current rating of the 24 V coil,

(iii) appropriate current rating of the 12 V coil.

(b) Draw the outlines of core type and shell type transformer. Also discuss the advantage/disadvantage of these constructions. **(10)**

(c) Why transformers get heated during operation? Name few cooling methods. **(10)**

Contd P/4

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8. (a) What are the conditions for parallel operation of two 3-phase transformers? **(8)**

(b) A 3-phase 33 KV/11 KV, 20/28 MVA (ONAN/ONAF) power transformer is to be connected in Δ-Y_n-11 mode. The coil polarities are given below: **(20)**

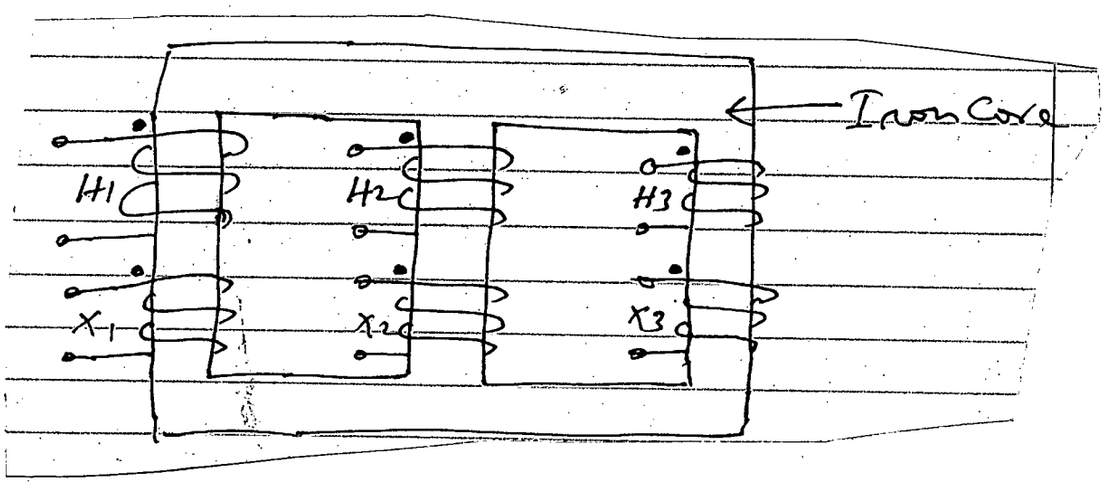

Fig. for Q 8(b)

The voltage rating of H_1, H_2, H_3 coils are $33/\sqrt{3}$ KV, and voltage rating of X_1, X_2, X_3 coils and $11/\sqrt{3}$ KV respectively.

(i) Complete the connection so that the transformer operates in Δ-Y_n-11 mode,

(ii) Rearrange the connection so that the transformer operates in Δ-Y_n-1 mode.

(c) Explain why most power transformer are oil immersed. **(7)**

L-2/T-1/EEE **Date: 16/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2016-2017

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 any **THREE**.

1. (a) Calculate the current flowing through 10 kΩ resistance in the MOSFET circuit shown in Fig. for Q. 1(a). Q_1 and Q_2 are identical. Given: $\left(\mu_n Cox\frac{W}{L}\right)=1\,mA/V^2$ and $V_t=1V$. **(20)**

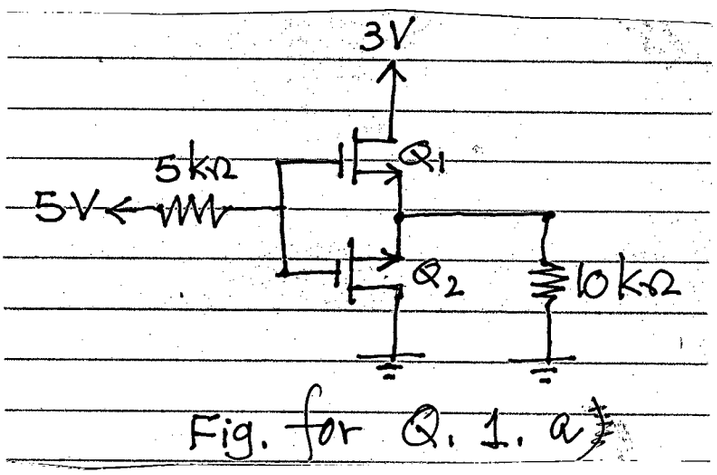

Fig. for Q. 1. a

(b) Explain operation of the circuit shown in Fig. for Q. 1(b) for the given input voltage, $v_{in}(t)$ and plot the output voltage, $v_{out}(t)$. Assume a forward drop of 0.7 V for diodes. **(15)**

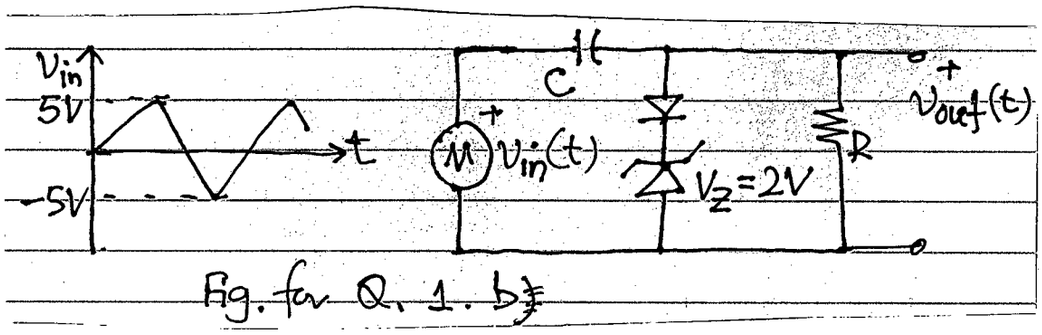

Fig. for Q. 1. b

2. (a) Calculate current through the n-channel MOSFET, Q_n in the CMOS circuit shown in Fig. for Q. 2(a). Given $V_{t_n}=-V_{t_p}=1\,V$. $L_n = L_p = 10\ \mu m$, $W_n = 30\ \mu m$, $W_p = 75\ \mu m$ and $\mu_n Cox = 2.5\ \mu_p Cox = 20\ \mu A/V^2$. **(17)**

Contd P/2

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Contd... Q. No. 2(a)

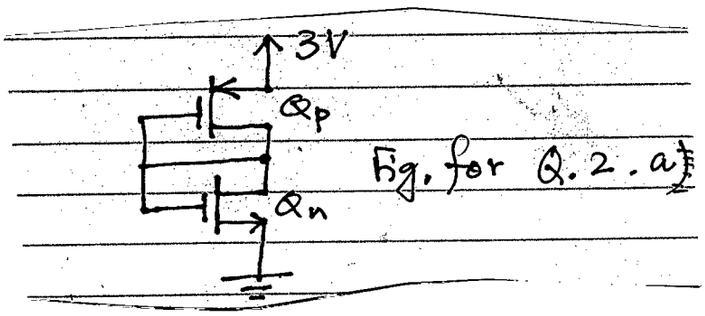

Fig. for Q. 2. a

(b) Design an electronic circuit using ideal diodes and other necessary components to obtain the transfer characteristics as shown in Fig. for Q. 2(b). **(18)**

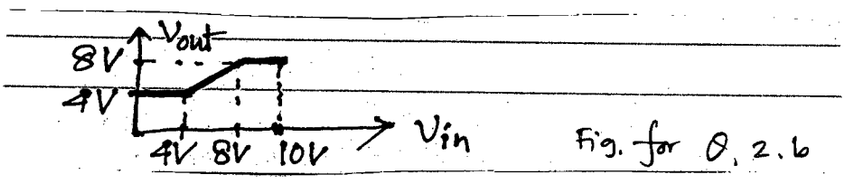

Fig. for Q. 2. b

3. (a) Three bulbs B_1, B_2, and B_3 are connected in a diode circuit as shown in Fig. for Q. 3(a). Calculate the power consumed by B_3 and the voltage drop across B_1. Assume a forward drop of 0.75 V for the diodes. **(20)**

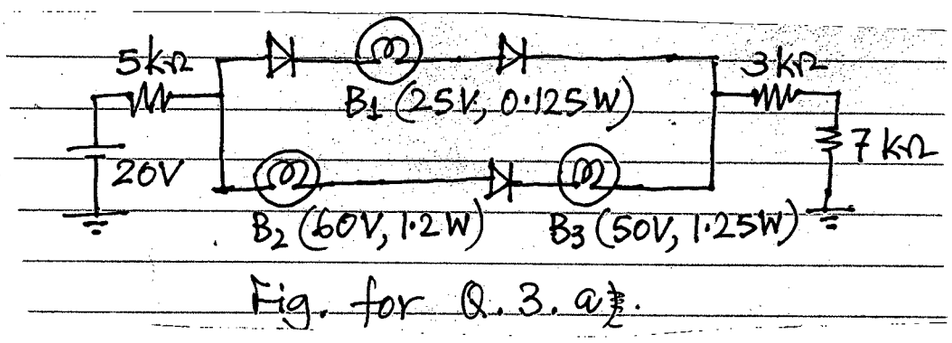

Fig. for Q. 3. a

(b) Draw a source follower amplifier circuit using p-channel MOSFET with proper biasing voltage and small input signal. Derive expressions for output resistance and voltage gain using small signal analysis. **(15)**

4. (a) Explain the operation of the diode circuit shown in Fig. for Q. 4(a) and draw the output voltage, v_0 as a function of the given input, v_i. Assume ideal diodes. **(18)**

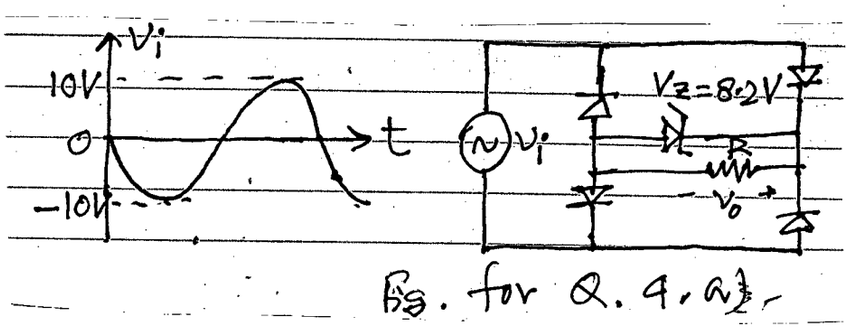

Fig. for Q. 4. a

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Contd... Q. No. 4

(b) Design the value of R_D if the transistor, Q_1 operates at the edge of saturation in the circuit shown in Fig. for Q. 4(b). Q_1 and Q_2 are identical. Given: V_t = 1 V and $\left(\mu_n Cox \frac{W}{L}\right) = 2\ mA/V^2$. Assume a forward drop of 0.7 V. For the diodes. **(17)**

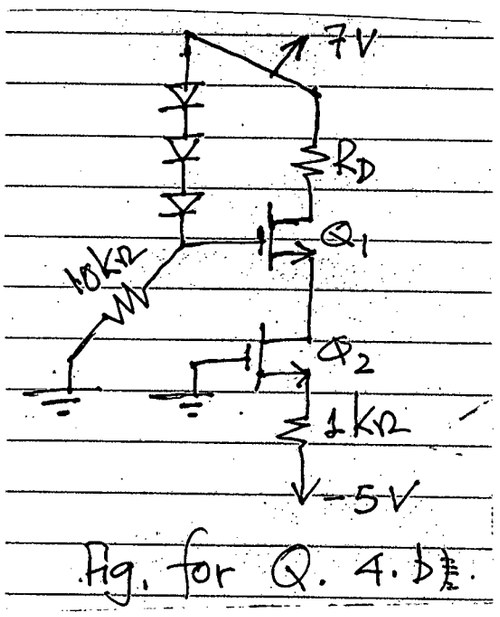

Fig. for Q. 4.b

SECTION-B

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

5. (a) Draw the circuit diagrams, voltage wave-shapes and transfer characteristics of full-wave center-tapped and bridge rectifiers. Assume constant voltage drop model for the diodes. Also compare their relative advantages and drawbacks. **(15)**

(b) A full-wave bridge rectifier circuit with a 1-kΩ load operates from a 220-V (rms) 50 Hz supply through a 10-to-1 step-down transformer. It uses four diodes, each of which can be modeled to have a 0.7-V drop for any current. **(20)**

(i) What is the peak value of the rectified voltage across the load?

(ii) For what fraction of a cycle does each diode conduct?

(iii) What is the peak-inverse voltage?

(iv) What is the average voltage across the load?

(v) What is the average current through the load?

Contd P/4

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6. (a) For the circuit shown in Fig. for Q. 6(a), the peak values of v_s is V_P. Draw the wave-shapes of v_s, v_0, i_L and i_D. Also determine the expressions of **(17)**

(i) peak-to-peak ripple voltage, V_r.

(ii) diode conduction interval, Δt.

Make necessary assumptions.

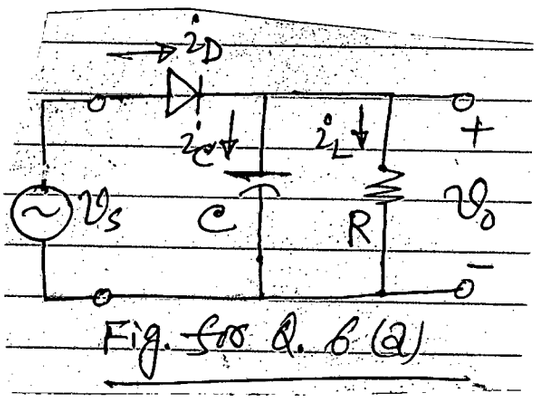

Fig. for Q. 6 (a)

(b) Assuming constant voltage-drop model of silicon diodes, determine the wave-shapes of v_0 for the circuits shown in Fig. for Q. 6(b). Given that $v_s = 10\sin(2\pi\times10^3 t)$ volts. Make necessary assumptions. **(18)**

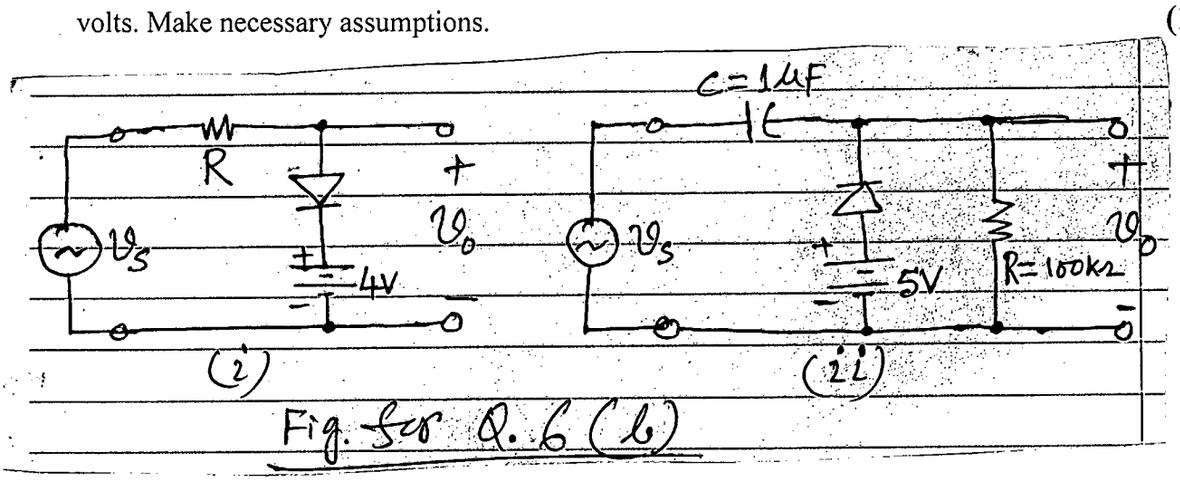

Fig. for Q. 6 (b)

7. (a) Draw the common-emitter output characteristics of an npn BJT and explain Early effect. Also draw the large-signal equivalent circuit model (including early effect) for the BJT operating in active-mode of operation. **(10)**

(b) Determine the voltages at all nodes and currents through all branches in the circuit shown in Fig. for Q. 7(b). Assume $\beta = 100$. **(12)**

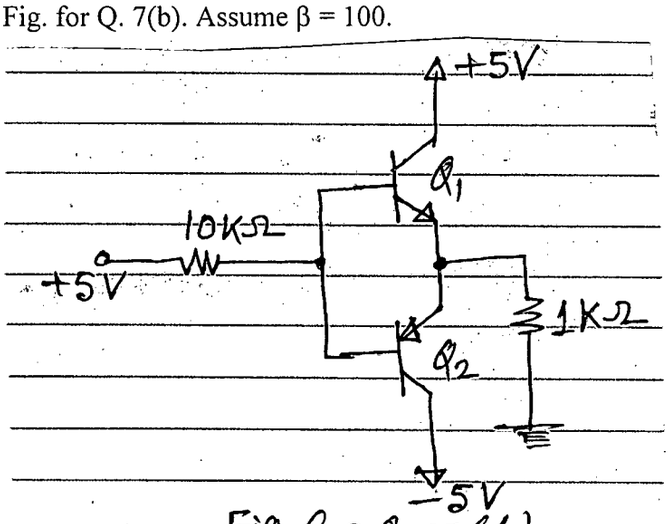

Fig. for Q. 7(b)

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Contd... Q. No. 7

(c) **(13)**

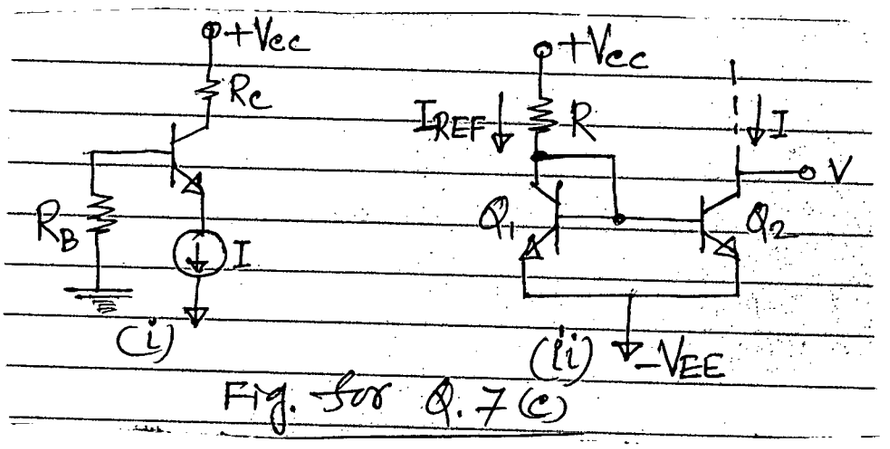

Fig. for Q. 7(c)

Briefly explain the constant-current source amplifier biasing circuit shown in Fig. for Q. 7(c). For the circuit shown in Fig. for Q. 7(c)(i), the V_{cc} = 10 V, I = 1 mA, β = 100, R_B = 100 kΩ, and R_C = 7.5 kΩ, find the dc voltage at the base, the emitter and the collector. For V_{EE} = 10 V, find the required value of R in order the circuit of Fig. for Q. 7(c)(ii) to implement the current source I.

8. (a) For the circuit shown in Fig. for Q. 8(a), under small-signal condition, determine the expressions of g_m, r_π, r_e and A_v. Where the symbols bear usual meanings. **(15)**

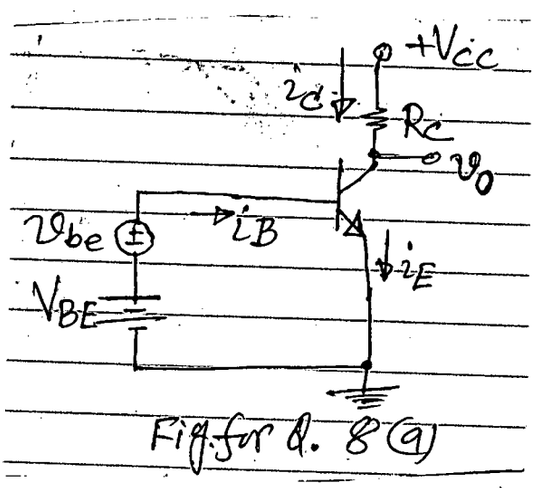

Fig. for Q. 8(a)

(b) In the circuit of Fig. for Q. 8(b), v_s is a small sine-wave signal. Draw the small-signal equivalent circuit of the amplifier and determine R_{in}, R_{out} and overall voltage gain. Assume β = 100 and r_0 = 200 kΩ. **(20)**

Contd P/6

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Contd... Q. No. 8(b)

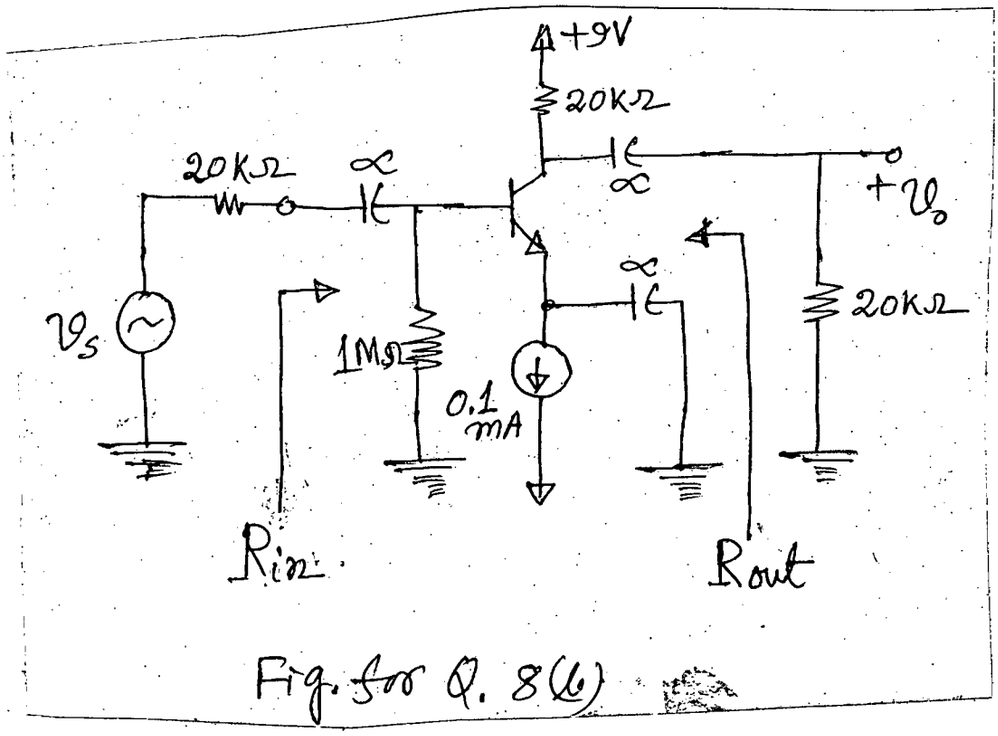

Fig. for Q. 8(b)

L-2/T-1/EEE **Date : 16/07/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2016-2017

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

Full Marks: 210 Time : 3 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) Define Hermitian matrix and skew- Hermitian matrix with examples. Prove that every square matrix can be uniquely expressed as P+iQ, where P and Q are Hermitian matrices. **(10)**

(b) Define elementary matrix. Find a sequence of elementary matrices that can be used to write the matrix A in row-echelon form, where $A=\begin{bmatrix}0 & 1 & 3\\ 1 & -3 & 0\\ 2 & -6 & 2\\ 0 & 1 & 4\end{bmatrix}$. **(11)**

(c) Factorize the matrix $A=\begin{bmatrix}1 & 2 & 3\\ 2 & 5 & 3\\ 1 & 0 & 8\end{bmatrix}$ into LU, where L is lower triangular matrix and U is upper triangular matrix. **(14)**

2. (a) If $A=\begin{bmatrix}3 & -3 & 4\\ 2 & -3 & 4\\ 0 & -1 & 1\end{bmatrix}$, find two non-singular matrices P and Q such that $PAQ = I$. Hence find A^{-1}. **(15)**

(b) Check the consistency of the following system of linear non homogeneous equations and find the solution, if it exists. **(10)**

$$x_1 + x_2 + 2x_3 = 9;\ 2x_1 + 4x_2 - 3x_3 = 1;\ 3x_1 + 6x_2 - 5x_3 = 0.$$

(c) Let $\vec{u}$ be the eigenvector of $A_{n\times n}$ associated with the eigenvalue λ. Then prove that the eigenvalue of $a_kA^k + a_{k-1}A^{k-1} + \cdots + a_1A + a_0I$ associated with the eigenvector $\vec{u}$ is $a_k\lambda^k + a_{k-1}\lambda^{k-1} + \cdots + a_1\lambda + a_0$, where $a_k, a_{k-1}, \cdots, a_1, a_0$ are real numbers and k is a positive integer. **(10)**

Contd P/2

3. (a) Find the eigenspace, algebraic multiplicity and geometric multiplicity for each eigenvalue for the matrix $A = \begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$. **(18)**

(b) If $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \\ 0 & 2 & -2 \end{bmatrix}$, find the value of A^n using Cayley Hamilton Theorem. Hence verify your result for n = 2. **(17)**

4. (a) Find the degree of minimal polynomial of the matrix $A = \begin{bmatrix} 6 & 2 & -2 \\ 2 & 3 & -1 \\ -2 & -1 & 3 \end{bmatrix}$. Is the matrix A derogatory or not? If yes, then express characteristic polynomial as the product of minimal polynomial and one of its monic factors. **(15)**

(b) Define quadratic form and explain its matrix representation. Reduce the matrix A given below to diagonal form. Interpret the result in terms of quadratic form. Also write down the corresponding equations of transformation. **(20)**

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 2 & 0 \\ 3 & 0 & -2 \end{bmatrix}$$

SECTION – B

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

5. (a) Derive the standard matrices for the following operations on $\Re^3$: **(20)**

A rotation of 45° about the y-axis, followed by an orthogonal projection on the yz plane, followed by a dilation with a factor k = 2.

Hence find the standard matrix for the stated composition of linear operators on $\Re^3$. Also find the image of the point (-1,-2,3) with respect to the stated composition of linear operators $\Re^3$. Also determine whether the matrix operator on $\Re^3$ defined by the composition is one to one.

(b) Determine whether the following subset **(15)**

W = {All vectors of the form (a,b,c,d), where d = a + b and c = a – b}

is a subspace of $\Re^4$. If so, find the dimension of the subspace W.

Contd P/3

MATH 259/EEE

6. (a) (i) Find a subset of the vectors **(20)**

$$\mathbf{v}_1 = (-1,3,2,4),\ \mathbf{v}_2 = (2,-7,-5,-9),\ \mathbf{v}_3 = (0,2,2,2),\ \mathbf{v}_4 = (4,0,4,-4),$$
$$\mathbf{v}_5 = (5,1,6,-4),\ \mathbf{v}_6 = (-3,4,1,7)$$

that forms a basis for the space spanned by these vectors.

(ii) Express each vector not in the basis as a linear combination of the basis vectors. Also find their co-ordinate vectors with respect to that basis.

(b) Discuss how the rank of A varies with t. **(15)**

$$A = \begin{bmatrix} t & 3 & -1 \\ 3 & 6 & -2 \\ -1 & -3 & t \end{bmatrix}$$

7. (a) Find the basis for the orthogonal complements of the row space of **(15)**

$$A = \begin{bmatrix} 1 & 4 & 5 & 6 & 9 \\ 3 & -2 & 1 & 4 & -1 \\ -1 & 0 & -1 & -2 & -1 \\ 2 & 3 & 5 & 7 & 8 \end{bmatrix}.$$

Also verify the Dimension theorem for the matrix A.

(b) Consider the basis $S = \{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ for $\Re^3$, where **(20)**

$$\mathbf{v}_1 = (1,1,1),\ \mathbf{v}_2 = (1,1,0),\ \mathbf{v}_3 = (1,0,0)$$

Let $T : \Re^3 \to \Re^2$ be the linear transformation for which

$$T(\mathbf{v}_1) = (1,0),\ T(\mathbf{v}_2) = (2,-1),\ T(\mathbf{v}_3) = (4,3)$$

Find a formula for $T(x_1, x_2, x_3)$, and then use that formula to compute $T(2,-4,-3)$.

8. Let P_2 have the inner product $\langle \mathbf{u}, \mathbf{v} \rangle = \int_{-1}^{1} u(x)v(x)dx$. Use Gram-Schmidt process to transform the basis $S = \{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ into an orthonormal basis $\{\mathbf{q}_1, \mathbf{q}_2, \mathbf{q}_3\}$. **(35)**

$$\mathbf{u}_1 = 1 + x,\ \mathbf{u}_2 = 1 + x^2,\ \mathbf{u}_3 = x + x^2$$

Hence find the coordinate vector of $\mathbf{w} = 2 - x + x^2$ with respect to the orthonormal basis $\{\mathbf{q}_1, \mathbf{q}_2, \mathbf{q}_3\}$. Also verify the Pythagorean theorem for the vectors $\mathbf{q}_1$, $\mathbf{q}_3$.

L-2/T-1/EEE **Date : 09/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2016-2017

Sub : **HUM 135** (English)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer Q. 1 and any other **TWO** from the rest.

1. (a) Explain with reference to the context any <u>two</u> of the following: **(15)**

(i) 'His specs – use them as burning glasses!'

(ii) "It's what causes you to have money. If you're lucky you have money."

(iii) "They were watching me as they would watch a conjurer about to perform a trick."

(b) Answer any <u>one</u> of the following: **(15)**

(i) "The tone of the story 'An Astrologer's Day' is both sarcastic and sympathetic to the astrologer". Elucidate.

(ii) What does D. H. Lawrence intend to delineate in the story 'The Rocking Horse Winner'?

(c) Answer any <u>three</u> of the following: **(15)**

(i) Give a graphic description of the place where the astrologer designed his studio to run his business.

(ii) "The young men said it was a damn shame to shoot an elephant for killing a coolie." How would you react to it as a young reader?

(iii) How was the island where the children landed on after the plane crash?

(iv) How does the astrologer bluff Guru Nayak?

(v) Do you think that Paul is the victim of modern capitalist society?

2. (a) Recast and correct any <u>ten</u> of the following sentences: **(15)**

(i) The habits of Copperheads are different from Diamond Backs.

(ii) Do you think we have paid too much? Too little?

(iii) Our captain was first in the seedings and our other two players seventh and ninth.

(iv) Himel was brash, was irritable, and was rude.

(v) The contractors applied the final coat of cement and laid the concrete base on rainy days.

(vi) Kamal would not help us in any way, shape or form.

(vii) The president's explanation represented a consensus of opinion.

(viii) Mr. Khan said. "I honestly believe "The money changers have fled the temple" today".

(ix) They expected the offer as soon as it was made.

(x) The music created the delusion that it was coming from the next room.

(xi) The number of money needed became larger every day.

(xii) The book will become more and more invaluable as the years pass.

Contd P/2

HUM 135/EEE

Contd... Q. No. 2

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

Facile, inert, ratify, unanimous, akin, palatable, outrageous, zealot, commend, put up with, eulogy, expound.

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

(i) The woods are lovely, dark and deep,
But I have promises to keep,
And miles to go before I sleep,
And miles to go before I sleep.

(ii) Real generosity lies in doing something for humanity. No act of kindness, however small, is ever wasted.

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

Most of the luxuries and many of the so-called comforts of life are not only indispensable, but positive hindrances to the elevation of mankind. With respect to luxuries and comforts, the wisest have ever lived a more simple and meager life than the poor. The ancient philosophers, Chinese, Hindu, Persian and Greek, were a class than which none has been poorer in outward riches, none so rich inward..... . None can be an impartial or wise observer of human life but from the vantage ground of what we should call voluntary poverty. Of a life of luxury, the fruit is luxury, whether in agriculture or commerce, or literature, or art. There are now-a-days professors of philosophy but not philosopher.... . To be a philosopher is not merely to have subtle thoughts, nor even to found a school, but so to love wisdom as to live according to its dictates, a life of simplicity, independence, magnanimity and trust. It is to solve some of the problems of life, not only theoretically, but also practically.

SECTION-B

There are **FOUR** questions in this section. Answer Q. 5 and any other **TWO** from the rest..

5. Read the following passage carefully and answer the questions below: **(45)**

Artist invented the first pigments – a combination of soil, animal fat, burnt charcoal, and chalk – as early as 40,000 years ago, creating a basic palette of five colors: red, yellow, brown, black and white. Since then, the history of color has been one of perpetual discovery, whether through exploration or scientific advancement. The invention of new pigments accompanied the developments of art history's greatest movements – from the Renaissance to Impressionism – as artist experimented with colors never before seen in the history of painting.

Contd P/3

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Contd... Q. No. 5

Found in iron-rich soil and first employed as an artistic material in prehistoric cave paintings, red ochre is one of the oldest pigments still in use. Centuries later, during the 16th and 17th centuries, the most popular red pigment came from a cochineal insect, a creature that could only be found on prickly-pear cacti in Mexico. These white bugs produced a potent red dye so sought-after by artists and patrons that it quickly became the third greatest import out of the "New World" (after gold and silver), as explains Victoria Finlay in **A Brilliant History of Color in Art**. Raphael, Rembrandt, and Rubens all used cochineal as a glaze, layering the pigment atop other reds to increase their intensity. A non-toxic source for red pigment, the cochineal bug is still used to color lipsticks and blush today.

Ever since the Medieval era, painters have depicted the Virgin Mary in a bright blue robe, choosing the color not for its religious symbolism, but rather for its hefty price tag. Mary's iconic hue – called ultramarine blue – comes from lapis lazuli, a gemstone that for centuries could only be found in a single mountain range in Afghanistan. This precious material achieved global popularity, adorning Egyptian funerary portraits, Iranian Qurans, and later the headdress in Vermeer's **Girl with a Pearl Earning** (1665). For hundreds of years, the cost of lapis lazuli rivaled even the price of gold. In the 1950s, Yves Klein collaborated with a Persian paint supplier to invent a synthetic version of ultramarine blue, and this color became the French artist's signature. Explaining the appeal of this historic hue Klein said, "Blue has no dimensions. It is beyond dimensions".

The darkest pigment found in Old Masters paintings is aptly named "bone black," and is produced by burning animal bones in air-free chamber. While the Impressionists avoided black paint–finding areas of darkness to be filled with color–American artists in the '50s and '60s returned to black. Frank Stella, Richard Serra, and Ad Reinhardt all created monochromatic black paintings, stripping the canvas of any subject matter other than the paint itself. Taken together, these painters prove that black is as nuanced a color as any other, capable of many permutations, tones and textures. Speaking about his practice in 1967, Reinhardt quoted the Japanese painter and printmaker Katsushika Hokusai, saying, "There is a black which is old and a black which is fresh. Lustrous black and dull black, black in sunlight and black in shadow."

Contd P/4

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Contd... Q. No. 5

Of all the pigments–Chrome Yellow, Scheele's Green, Paris Green – that has been banned over the centuries, the color most missed by painters is likely Lead White. This hue could capture and reflect a gleam of light like no other, though its production was anything but glamorous. The 17th-century Dutch method for manufacturing the pigment involved layering cow and horse manure over lead and vinegar. After three months in a sealed room, these materials would combine to create flakes of pure white. While scientists in the late 19th century identified lead as poisonous, it wasn't until 1978 that the United States banned the production of lead white paint. In this era, Robert Rauschenberg, Robert Ryman and Agnes Martin turned to titanium and zinc whites to create monochromatic white paintings, while artists like Dan Flavin bypassed pigments altogether in sculptures that emitted white light directly.

Questions:

(i) How did the invention of new pigments contribute to the development of art history?

(ii) What was the reason behind the appeal of blue as a 'religious symbolic' colour?

(iii) Why did the American painters create monochromatic black paintings in 50's and 60's?

(iv) Describe the process of producing red and white pigments in 16^{th} and 17^{th} centuries.

(v) Write down a suitable title for this passage and justify it.

6. (a) Briefly discuss the main function of the introductory paragraph in a sales letter. **(10)**

(b) Suppose, the manager of a company has asked you to replace 15 printers he bought from your store ten days ago. Draft a suitable reply. **(10)**

(c) Write phonetic transcriptions of the following words (any five): **(10)**

Adjective, Debt, Feather, White, Colonel, Ballet.

7. (a) What is glossary of a formal report? **(5)**

(b) Write a composition on <u>any one</u> of the following: **(15)**

(i) Netiquette: A Code of Conduct in Cyberspace

(ii) Climate Change: A Global Threat

(iii) Religious Extremism: Causes and Challenges.

(c) Write a dialogue between two students of BUET about their experience of participating at the 'National Power and Energy Hackathon-2017'. **(10)**

Contd P/5

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

(i) I could not do it even if I tried. (Simple)

(ii) Sitting on a stone, the old sailor watched people walking past him. (Compound)

(iii) Wayne was guilty of intolerable rudeness. (Complex)

(iv) We believed what he said. (Simple)

(v) Though he ran fast, he could not get train. (Compound)

(vi) They soon forgot their past labors. (Complex)

(b) What are the characteristics features of a covering letter? **(5)**

(c) Write short notes on <u>any three</u> of the following: **(15)**

(i) Thesis Statement

(ii) Genre

(iii) Bibliography

(iv) Inventory Report

(v) Phone

L-2/T-1/EEE **Date : 05/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2016-2017

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

Full Marks : 280 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**.

1. (a) Determine if the systems with the following impulse response are memoryless, causal, and stable: **(15)**

   (i) $h(t) = \delta(t) - \delta(t-2)$,

   (ii) $h(t) = 2\,\text{rect}(t/2)$,

   (iii) $h(t) = 2e^{-4t}u(t)$,

   (iv) $h(t) = [1 - e^{-4t}]u(t)$.

   (b) Determine the impulse response of the system shown in the figure for Q. No. 1(b), if $h_1(t) = e^{-2t}u(t)$, $h_2(t) = e^{-2t}u(t)$, $h_3(t) = e^{-t}u(t)$, $h_4(t) = \delta(t)$ and $h_5(t) = e^{-3t}u(t)$. Find the output $y(t)$ of the system if the input $x(t) = u(t)$. Also, comment or the stability of the system. **(20)**

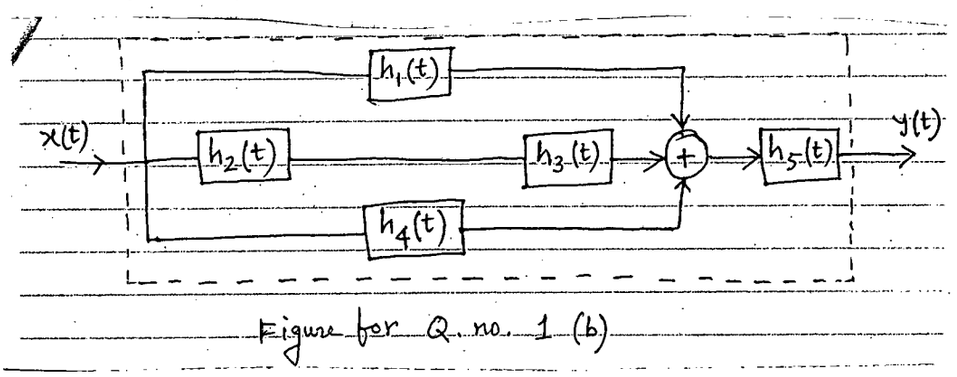

Figure for Q. no. 1 (b)

2. (a) State and explain the Dirichlet conditions of convergence for Fourier Series. **(10)**

   (b) The input to a system in given by $x(t)$ as shown in the following figure for Q. No. 2(b). **(25)**

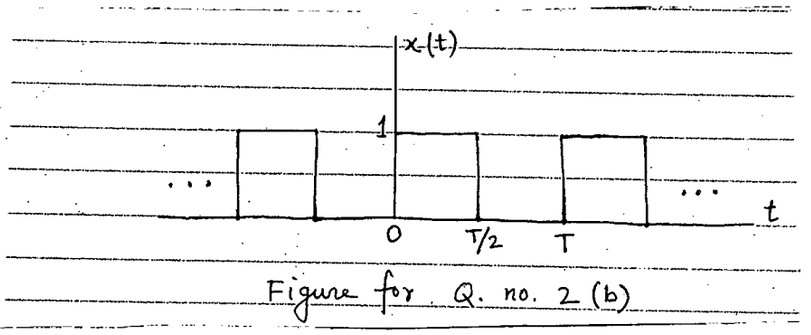

Figure for Q. no. 2 (b)

   (i) Find the exponential Fourier series of $x(t)$.

   (ii) Calculate the average power in $x(t)$ using parseval's theorem.

Contd P/2

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Contd ... Q. No. 2(b)

(iii) What will be the Fourier series of $\frac{dx(t)}{dt}$?

(iv) If the frequency response of the system is given by $H(\omega)=\frac{1}{1+j\omega}$, find the Fourier series of the output y(t) of the system.

(v) Plot the magnitude and phase spectrum of x(t).

3. (a) For the functions shown in figure for Q. No. 3(a), (i) show that the functions form an orthogonal set, (ii) Determine T that makes the three functions orthonormal, and (iii) Express the signal x(t) in terms of functions of the orthogonal set: **(15)**

$$x(t) = \begin{cases} A, & \text{for } 0 \le t \le T \\ 0, & \text{otherwise} \end{cases}$$

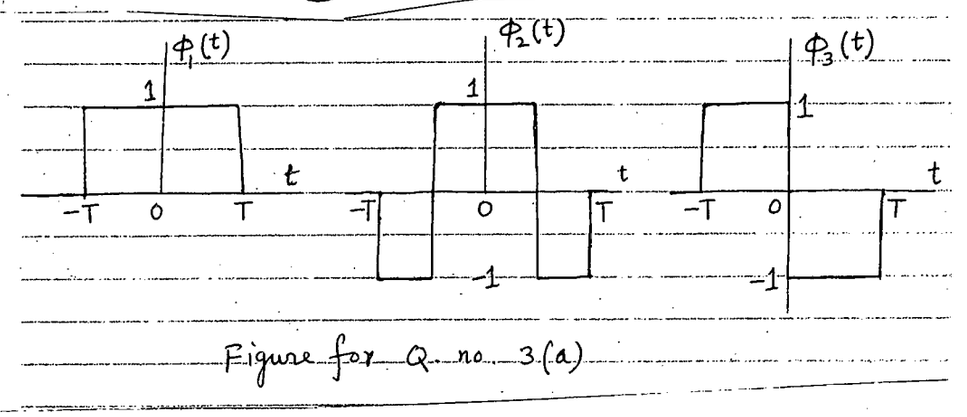

Figure for Q. no. 3(a)

(b) What is a distortionless LTI system? Find the relation between the Fourier Series coefficients of input and output of a distortionsless LTI system. **(10)**

(c) Find the impulse response of the initially relaxed system shown in figure for Q. No. 3(c): **(10)**

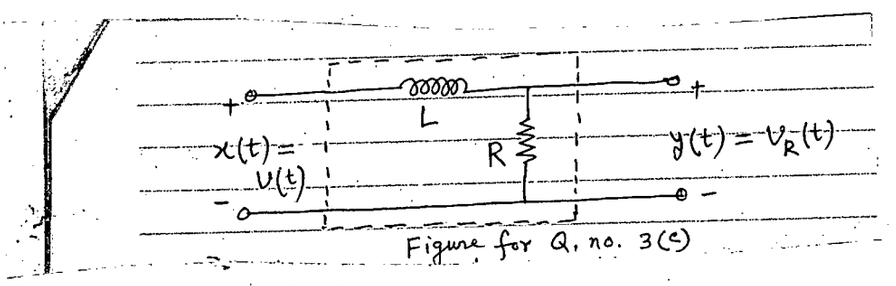

Figure for Q. no. 3(c)

Also, find the step response of the system.

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4. (a) Find a state space representation of the circuit shown in figure for Q. No. 4(a), assuming that the outputs are the currents flowing in R_1 and R_2. **(15)**

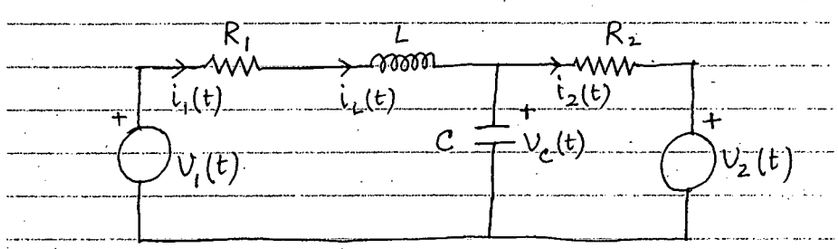

Figure for Q. no. 4(a)

(b) Write the properties of state transition matrix. Find an expression of the complete solution of response y(t) from state equations for continuous time LTI system and show that the impulse response is given by **(10)**

$$h(t)=\begin{cases}\bar{c}\bar{\phi}(t)\bar{b}+d\delta(t), t\geq 0\\ 0, \text{ otherwise}\end{cases}$$

where the variables have usual meanings.

(c) Represent the system with transfer function: **(10)**

$$H(s)=\frac{s^2-3s+2}{s^3+6s^2+11s+6}$$

by simulation diagram using canonical forms.

SECTION – B

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

5. (a) Sketch and label the signal

$$x(t) = (t + 1)\,[u(t + 2) - u(t)].$$ **(10)**

(b) The signal y(t) as shown in Fig. for Q. 5(b) is obtained by the transformation

$$y(t) = x(-2t + 6).$$ **(15)**

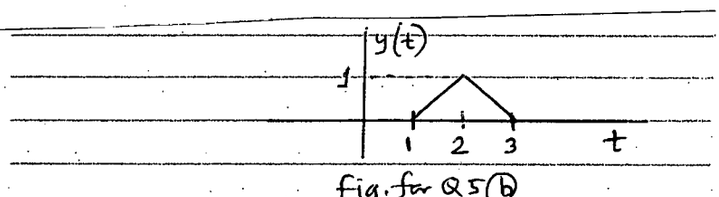

fig. for Q5(b)

Sketch the signal x(t).

(c) Determine whether the signal $x(t) = \cos(100\,\pi t + \pi/3) + \sin(40\pi\, t + 2\pi/3)$ is periodic or not. If it is periodic, find the fundamental period of the signal. **(10)**

Contd P/4

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6. (a) Determine the Fourier transform of the rectangular pulse x(t)=rect(t/τ). Use this result to find the Fourier transform of the triangular pulse defined as **(12)**

$$y(t)=\Delta(t/\tau)=\begin{cases}1-|t|/\tau, & |t|\le\tau\\ 0, & |t|>\tau\end{cases}$$

using the convolution property of Fourier transform.

(b) Determine the energy of the signal **(11)**

$$x(t)=\frac{\sin(2\pi\times10(t-1/40))}{\pi(t-1/40)}\cos(2\pi\times15t).$$

(c) Consider the system depicted in Fig. for Q. No. 6(c) where **(12)**

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

$$h(t)=\frac{\sin(3\omega_B t/2)}{\pi t}$$

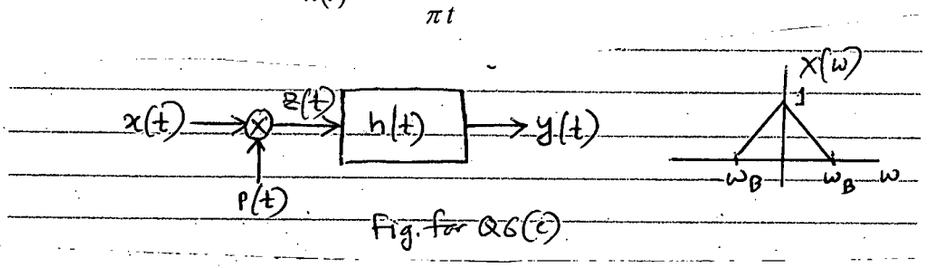

Fig. for Q6(c)

The input to the system has the spectrum shown in the same figure. Sketch the frequency spectrum of p(t), z(t), h(t) and y(t).

7. (a) Determine the bilateral and unilateral Laplace transform of the signal **(11)**

$$x(t)=e^{at}u(-t),\ a>0.$$

(b) The Laplace transform of the signal x(t) that is zero for t < 0 is **(12)**

$$X(s)=\frac{s^3+2s^2+3s+2}{s^4+2s^3+2s^2+2s+2}$$

Determine the Laplace transform of the signal

$$y(t)=tx(t)+\frac{dx(t)}{dt}+\int_0^t x(\tau)d\tau.$$

(c) Consider the system shown in Fig. for Q. 7(c). **(12)**

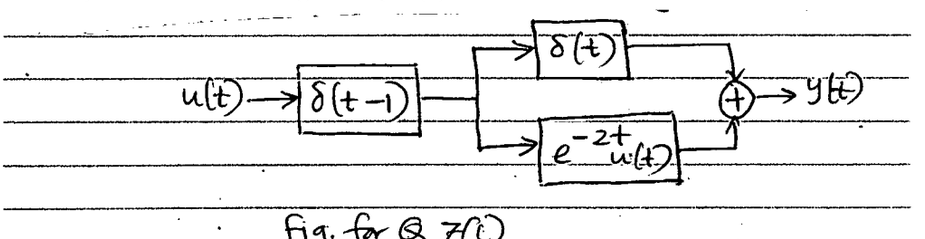

Fig. for Q 7(c)

Determine Y(s) and y(t).

Contd P/5

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8. (a) Determine the impulse response h(t) of the ideal band stop filter whose frequency response is shown in Fig. for Q. No. 8(a). **(12)**

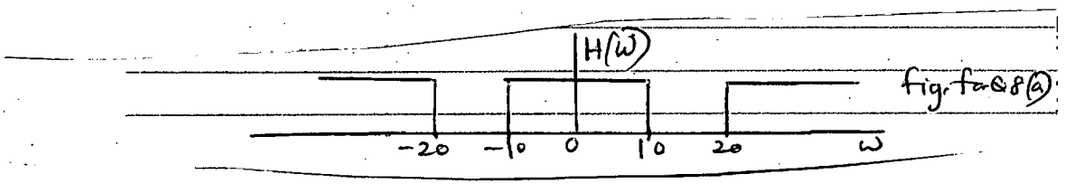

Fig. for Q8(a)

(b) Consider the RLC circuit shown in Fig. For Q. No. 8(b). **(12)**

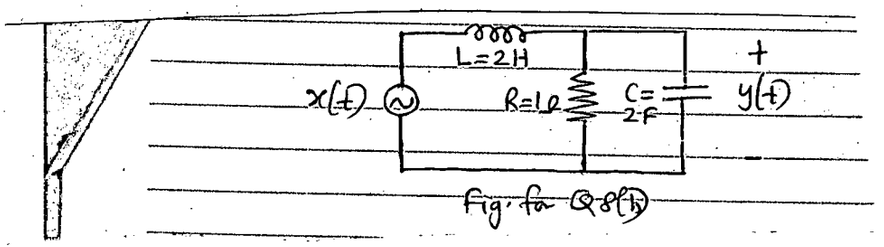

Fig. for Q8(b)

Determine the transfer function H(s) = Y(s)/X(s) and impulse response h(t) of the RLC circuit.

(c) For the mechanical system shown in Fig for Q. No. 8(c), draw the f – i (force – current) analogous electrical circuit and write the equation of motion in terms of the given mechanical quantities. **(11)**

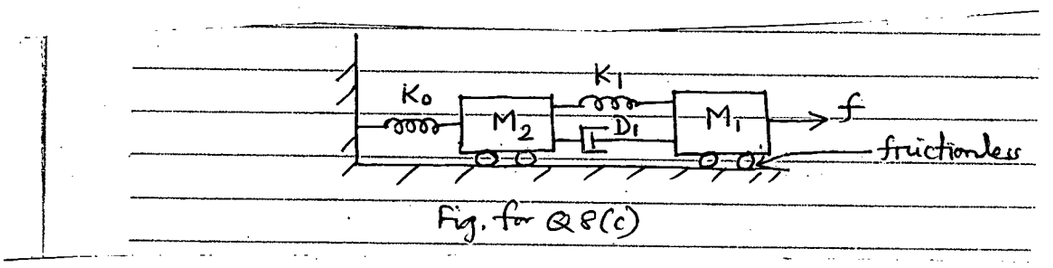

Fig. for Q8(c)
