

MINISTRY OF SCIENCE AND TECHNOLOGY  
THE DEPARTMENT OF ADVANCED SCIENCE AND TECHNOLOGY  
UNIVERSITIES OF COMPUTER STUDIES

THIRD YEAR (B.C.Sc. / B.C.Tech.)

FIRST TERM EXAMINATION

MARCH, 2013

ENGLISH

**Answer All Questions.**

**Time allowed: 3 hours**

**QUESTION - I**

A Water is the giver and, at the same time, the taker of life. It covers most of the surface of the planet we live on and features large in the development of the human race. On present predictions, it is an element that is set to assume even greater significance.

B Throughout history, water has had a huge impact on our lives. Humankind has always had a rather ambiguous relationship with water, on the one hand receiving enormous benefit from it, not just as a drinking source, but as a provider of food and a means whereby to travel and to trade. But forced to live close to water in order to survive and to develop, the relationship has not always been peaceful or beneficial. In fact, it has been quite the contrary. What has essentially been a necessity for survival has turned out in many instances to have a very destructive and life-threatening side.

C Through the ages, great floods alternated with long periods of drought have assaulted people and their environment, hampering their fragile fight for survival. The dramatic changes to the environment that are now a feature of our daily news are not exactly new: fields that were once lush and fertile are now barren; lakes and rivers that were once teeming with life are now long gone; savannah has been turned to desert. What perhaps is new is our naïve wonder when faced with the forces of nature.

D Today, we are more aware of climatic changes around the world. Floods in far-flung places are instant news for the whole world. Perhaps these events make us feel better as we face the destruction of our own property by floods and other natural disasters.

E In 2002, many parts of Europe suffered severe flood damage running into billions of euros. Properties across the continent collapsed into the sea as waves pounded the coastline wreaking havoc with sea defences. But it was not just the seas. Rivers swollen by heavy rains and by the effects of deforestation carried large volumes of water that wrecked many communities.

F Building stronger and more sophisticated river defences against flooding is the expensive short-term answer. There are simpler ways. Planting trees in highland areas, not just in Europe but in places like the Himalayas, to protect people living in low-lying regions like the Ganges Delta, is a cheaper and more attractive solution. Progress is already being made in convincing countries that the emission of carbon dioxide and other greenhouse gases is causing considerable damage to the environment. But more effort is needed in this direction.

G And the future? If we are to believe the forecasts, it is predicted that two-thirds of the world population will be without fresh water by 2025. But for a growing number of regions of the world the future is already with us. While some areas are devastated by flooding, scarcity of water in many other places is causing conflict. The state of Texas in the United States of America is suffering a shortage of water with the Rio Grande failing to reach the Gulf of Mexico for the first time in 50 years in the spring of 2002, pitting region against region as they vie for water sources. With many parts of the globe running dry through drought and increased water consumption, there is now talk of water being the new oil.

H Other doom-laden estimates suggest that, while tropical areas will become drier and uninhabitable, coastal regions and some low-lying islands will in all probability be submerged by the sea as the polar ice caps melt. Popular exotic destinations now visited by countless tourists will become no-go areas. Today's holiday hotspots of southern Europe and elsewhere will literally become hotspots – too hot to live in or visit. With the current erratic behaviour of the weather, it is difficult not to subscribe to such despair.

I Some might say that this despondency is ill-founded, but we have had ample proof that there is something not quite right with the climate. Many parts of the world have experienced devastating flooding. As the seasons revolve, the focus of the destruction moves from one continent to another. The impact on the environment is alarming and the cost to life depressing. It is a picture to which we will need to become accustomed.

### Questions 1-9

*Choose the most suitable heading for each paragraph from the list of headings below.*

#### List of Headings

- i Environmental change has always been with us
- ii The scarcity of water
- iii Rivers and seas cause damage
- iv Should we be despondent? Or realistic?
- v Disasters caused by the climate make us feel better
- vi What is water?
- vii How to solve flooding
- viii Humans' relationship with water
- ix A pessimistic view of the future

- |                |                |                |
|----------------|----------------|----------------|
| 1. Paragraph A | 4. Paragraph D | 7. Paragraph G |
| 2. Paragraph B | 5. Paragraph E | 8. Paragraph H |
| 3. Paragraph C | 6. Paragraph F | 9. Paragraph I |

### Questions 10-15

Using **NO MORE THAN THREE WORDS** from the passage, complete the sentences below.

10. Humankind's ..... with water has been two-sided.
11. The writer suggests that our surprise at the environmental change brought about by ..... is something new.
12. According to the text, ..... is a less expensive answer to flooding than building river defences.
13. By 2025, it is projected that the majority of the world population will not have .....
14. According to the text, in the future ..... are likely to be under water.
15. According to the writer, people will need to get used to ..... changes that cause environmental damage.

### QUESTION-II

Answer these questions.

1. How long have you been studying?
2. What subjects have you found the most difficult to study?
3. What do you enjoy/dislike about studying?
4. Have you gained/Do you hope to gain any qualifications?
5. Do you hope to do any further studies in the future?
6. Is English important in your chosen career?
7. What do you hope to do in the future?

### QUESTION-III

Combine each pair of sentences. Use a **to-infinitive** or an **-ing** form. Sometimes you also need a preposition.

1. We saw Rupert. He was looking in a shop window.  
.....
2. I remember the clown. He fell over.  
.....
3. Tessa wasn't sure. Which way should she go?  
.....
4. The porter just stood there. He expected a tip.  
.....
5. How about it? Shall we go to the barbecue?  
.....
6. Susan is used to it. She's always lived in the country.  
.....
7. I'm afraid. I might hurt myself.  
.....

8. Christopher apologized. He'd forgotten to pay.  
.....

9. The food was too cold. Michelle couldn't eat it.  
.....

10. Polly was silly. She gave away the secret.  
.....

#### QUESTION-IV

Choose the correct answers.

The National Security Bank in downtown San Antonio 1.....(robbed / was robbed) last night. A safe 2.....(blew open /was blown open)and around \$800,000 3.....(stole/was stolen). The robbery 4.....(took / was taken) place between midnight and 1.00am. The police 5.....(are looking/are being looked) for two men who 6.....(saw/were seen ) getting into a black car near the bank at about 1 o'clock last night. They 7..... (also want / are also wanted) to hear from Mr.Joe Newman, 52, who 8.....(worked/ was worked) as a security guard at the bank. Mr. Newman 9.....(disappeared/was disappeared) just before the robbery and he 10.....(has not seen/ has not been seen) since then.

#### QUESTION-V

Write a second sentence so that it has a similar meaning to the first. Use the word in brackets.

1. The children were eager to see their presents. (wait)  
.....

2. I hate to get up in the dark. (stand)  
.....

3. By chance I saw your brother yesterday. (happened)  
.....

4. The shop usually opens ten minutes late. (tends)  
.....

5. Would you like to go for a walk? (fancy)  
.....

#### QUESTION-VI

***Television has done more harm than good to society.*** Do you agree? Use specific reasons and details to support your opinion.

END

**Department of Advanced Science and Technology**  
**University of Computer Studies**  
**B.C.Sc. / B.C.Tech. (Third Year)**  
**CST-301 (Computer Organization + Artificial Intelligence)**  
**First Term Examination**

March 2013

**Answer All questions.**

**Time allowed : 3 hours.**

1. Define Any Five of the following:  
(a) Ripple carry adder      (b) Clock cycle time      (c) Flip-Flops  
(d) Non-inverting buffer      (e) Interrupt vectors      (f) System Bus
2. Briefly explain Any Three of the following:  
(a) Translation and Interpretation  
(b) Synchronous bus and Asynchronous bus  
(c) Immediate addressing and Direct addressing  
(d) Ripple carry adder and Carry select adder
3. (a) Draw the 1-bit ALU with following operations:  
(i)  $\bar{A}$  AND  $\bar{B}$    (ii)  $\bar{B}$    (iii)  $A + B$    (iv)  $A \oplus B$   
(b) Draw the logic diagram for  $4 \times 3$  memory organization.  
(c) How to organize the 8 M bits memory chips using  $1024 \times 8$  bits to construct  $n \times n$  metrics method?
4. (a) Convert the following infix formula to reverse Polish notation and generate JVM code to evaluate it.  
$$(3 \times 4 + 5) - (6 / 3 + 1)$$
  
(b) Convert the following Java code to IJVM instruction.  
(i)  $x = y + 2;$   
 $z = 0;$   
 $if(x > 5) z = 5;$   
 $else x = x + 5;$   
(ii)  $a = c;$   
 $b = c + d - 1;$   
 $while b > 0 do$   
 $\{$   
 $b = b - 1;$   
 $c = c + 1;$   
}
5. (a) Define the following.  
(i) A rational agent   (ii) Semidynamic   (iii) Utility function   (iv) Abstraction  
(b) What are the task environments for the followings?  
(i) Taxi Driving      (ii) Crossword puzzle
6. (a) Discuss on Model-based Reflex Agents.  
(b) Describe the time and space complexity of Iterative Deepening search.  
(c) Give the initial state, goal test, successor function, goal test and cost function for the Vacuum world?

**Department of Advanced Science and Technology**  
**University of Computer Studies**  
**B.C.Sc./B.C.Tech. (Third Year)**  
**Mid Term Examination**  
**Mathematics of Computing III (CST-302)**  
**March, 2013**

**Answer ALL Questions.**

**Time Allowed: 3 hours.**

1. Solve the following differential equations.

(a)  $e^x y' = 2(x+1)y^2, \quad y(0) = \frac{1}{6}$

(b)  $2y^{-1} \cos 2x \, dx - y^{-2} \sin 2x \, dy = 0, \quad y\left(\frac{\pi}{4}\right) = 3.8$

(c)  $y' = 1 + y^2, \quad y(0) = 0$

2. Solve (a)  $4y'' - 25y = 0, \quad y(0) = 0, \quad y'(0) = -5$ .

(b)  $y'' + 4y = 0, \quad y(0) = 3, \quad y\left(\frac{\pi}{2}\right) = -3$ .

3. Solve (a)  $x^2 y'' - 2xy' + 2y = 0, \quad y(1) = \frac{3}{2}, \quad y'(1) = 1$ .

(b)  $y'' - 6y' + 13y = 4e^{3x}, \quad y(0) = 2, \quad y'(0) = 4$ .

4.(a) Suppose that a certain type of plastic tape contains, on the average, 2 defects per 100 meters. What is the probability that a roll of tape 300 meters long will contain (i) x defects, (ii) no defects?

(b) If the probability of hitting a target is 5% and 20 shots are fired independently, what is the probability that the target will be hit at least once?

(c) If the life of ball bearings has the density  $f(x) = \begin{cases} ke^{-x} & \text{if } 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$ , What is k? What is the probability  $P(X \geq 1)$ ?

5.(a) Find the Laplace transforms of the functions (i)  $f(t) = e^{2t} * \cos 4t$ ; (ii)  $f(t) = t \cos wt$ .

(b) Find the inverse Laplace transform of (i)  $F(s) = \frac{1}{(s+\sqrt{2})(s-\sqrt{3})}$  (ii)  $\frac{1}{s^2(s+1)}$  (By convolution)

(c) Solve the following initial value problems by the Laplace transform.

$$y'' + 2y' - 3y = 6e^{-2t}, \quad y(0) = 2, \quad y'(0) = -14$$

**Department of Advanced Science and Technology**  
**University of Computer Studies**  
**Third Year (B.C.Sc./B.C.Tech.)**  
**Mid-Term Examination**  
**Data and Computer Communications (CST-303)**  
**March, 2013**

**Answer All Questions.**

**Time allowed: 3 hours**

1. Define the followings:  
 (a) Star Topology                                  (f) Piggybacking  
 (b) Quality of Service                                (g) CRC  
 (c) Trunks    (h) ASK  
 (d) FHSS    (i) UTP  
 (e) WDM     (j) Channel Capacity                                **(each 2-marks)**
2. Answer ANY SIX of the followings:  
 (a) Difference between half-duplex and full-duplex transmission modes  
 (b) Distinguishing characteristics of optical fiber from others  
 (c) Delta Modulation  
 (d) Synchronous Transmission  
 (e) Selective-Retain ARQ  
 (f) Asymmetric Digital Subscriber Line  
 (g) Four categories of Noise  
 (h) Four key Routing Strategies  
 (i) Choke Packet  
 (j) The OSI Reference model                        **(each 4-marks)**
- 3.(a) Why is a statistical time division multiplexer more efficient than a synchronous time division multiplexer?  
 (b) Why must a satellite have distinct uplink and downlink communication? Give a brief explanation of satellite transmission.
- 4.(a) What are the key requirements for a routing function for a packet-switching network? Explain about fixed routing.  
 (b) What are the three frame types supported by HDLC? Explain two-way data exchange of HDLC operation.
- 5.(a) What is the difference between a hub and layer 2 switch? Discuss about a store-and-forward switch and a cut-through switch.  
 (b) Define DSSS and explain how it achieves bandwidth spreading.
6. What is the significance of packet size in a packet-switching network? Explain the difference between datagram and virtual circuit operation.

**(OR)**

How does the sampling rate affect the transmitted digital signal? Explain the steps that take an analog signal to PCM digital code. Also briefly explain the effect of nonlinear encoding.

**(each 14-marks)**

**Department of Advanced Science and Technology**  
**University of Computer Studies**  
**B.C.Sc(Third Year), Mid-Term Examination**  
**CS-304 (Software Engineering + UML)**  
**April, 2013**

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Answer ALL questions.

**Software Engineering**

1. Write short notes for **only two** of the followings:  
(i) Risk monitoring.  
(ii) The key factors which influence the effectiveness of group communication.  
(iii) The project plan structure. (20 marks)
2. (a) Briefly discuss about the People Capability Maturity Model (P-CMM) proposed by SEI?  
(10 marks)  
(b) What factors should be taken into account when selecting staff to work on a software development project?  
(10 marks)
3. The productivity of individual engineers working in an organization is affected by a number of factors. Explain these factors.  
(10 marks)  
(or)  
Product metric are concerned with the characteristics of the software itself. Briefly explain product metrics.  
(10 marks)

**Unified Modeling Language**

4. Define the following terms:  
(a) Generalization and Association  
(b) Multiplicity  
(c) Component diagram and Deployment diagram (6 Marks)
5. What are the Behavioral Diagrams in The Unified Modeling Language? Describe them.  
(8 Marks)
6. State the four kinds of which are the basic object-oriented building blocks of the UML and briefly describe all of them.  
(6 Marks)
7. Draw a Use Case Diagram to represent the following description of a course registration system: A student registers for his or her courses. To register, student adds courses; student may also drop courses. Student may print timetable. The administrator retrieves the class lists from the system. The administrator verifies that the student meets the enrollment requirements (this involves checking the Roll No, NRC No and Father Name). If the enrollment requirements are not met, then the administrator removes the student from the course, and notified the student. The instructor may retrieve a class list and he or she may also print a class list. Student may also waive enrollment requirements for a student.  
(10 Marks)

8. Create an UML Class diagram of an information modeling system for a University. University has one or more Departments. Department offers one or more subjects. A particular subject will be offered by only one department. Department has instructors and instructors can work for one or more departments. Instructors can teach up to 2 subjects. The same subject can be taught by different instructors. Furthermore, every student may attend any number of courses and every course may have any number of students.

(10 Marks)

9. Draw a collaboration diagram that specifies the flow of control involved in registering a new student at a school, with an emphasis on the structural relationships among these objects. There are five objects: a RegistrarAgent(r), a Student(s), two Course objects (c1 and c2), and an unnamed School Object. The flow of control is numbered explicitly. Action begins with the RegistrarAgent creating a Student object, adding the student to the school (the message addStudent), then telling the Student object to register itself. The Student object then invokes getSchedule on itself, presumably obtaining the Course objects for which it must register. The Student object then adds itself to each Course object. The flow ends with s rendered again, showing that it has an updated value for its registered attribute.

(10 Marks)

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(exam 01) Pieniä insinööriä

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(exam 01) Tiedotus ja teknologia

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Department of Advanced Science and Technology

University of Computer Studies

B.C.Sc. Third Year, Mid Term Examination

CS-305 Computer Application Technique III

April, 2013

Answer all questions

Time Allowed: 3 hours

Write property setting and code for following form design. At the start of form, basic price and shipping cost text boxes are disabled. When user selects a location in list box, these will be enabled. When user clicks 'Calculate' button, shipping cost and total cost will be display in text boxes. Shipping cost criteria on basic price are:

	USA	Japan	India
Medical Instruments	10%	5%	3%
Others Apparatus	20%	10%	7%

<b>Product Type</b> <input checked="" type="radio"/> Medical Instruments <input type="radio"/> Others Apparatus	<b>Basic Price: (\$)</b>	<input type="text" value="1000"/>
<b>Location of products</b>	<b>Shipping Cost: (\$)</b>	<input type="text" value="100"/>
<b>Total Cost: (\$)</b>	<input type="text" value="1100"/>	
<input type="button" value="Calculate"/>	<input type="button" value="Clear"/>	<input type="button" value="Close"/>

(15 marks)

- a) Write a program to find and delete the customer record(s) that remark fields is 'delete'. Before deleting, the record displays each record and confirm to user for deleting. If user agrees, delete this record. Otherwise, skips this record and going to find another record. After deleting the records in the table, display all deleted records in a message box. Use "Customer" table with Acc\_No, Cus\_ID, cName, Balance and remark fields in C:\bank.accdb database. (10 marks)
- b) Write a program that will update the 'Store\_item' table with 'Transition\_item' table. The data in both tables are as follow:

Store\_item Table

code_ID	Item	Balance
A001	Book	2000
A002	Pencil	2000
A003	Eraser	2500
A005	Pen	1500

Transition\_item Table

code_ID	Trans_Type	TAmount
A001	Receive	5000
A002	Issue	500
A005	Receive	1000

The 'Store\_item' table store in c:\my documents\store.accdb database and the 'Transaction\_item' table in current database. If the Trans\_Type is 'Issue', subtracts the TAmount from balance. If the Trans\_Type is 'Receive', adds the TAmount into balance. (10 marks)

3(a). Write a program codes that will display the students' information whose name start user given character(s) and user selected town. Required data will be accepted with input boxes. Use 'Student' table with rno, sname, and dob and town table with rno and town fields in current database.(5 marks)

(b). Write a function procedure called bonus() that calculate the bonus amount. It should take two arguments (double type) and return a value as double type. Write an event procedure that gets salary and bonus percent with input box and calls bonus() function and then displays the result in a message box. (bonus amount= salary \* bonus percent /100) (5 marks)

(c). Write a procedure that will insert the sale record into the table. Use 'Sale' table with code, item, price, qty and amount fields in c:\data.accdb database.

Remarks: amount =price \* qty (5 marks)

4.(a) Prepare a **Cash Budget** from the following information for the four months ( from January to April).

- Opening cash balance \$ 500.
- Production units for the year are-

Jan	Feb	Mar	Apr	May	June
160	180	200	180	160	200

- Estimated sales for the year are-

Nov	Dec	Jan	Feb	Mar	Apr
100	140	90	140	120	150

- A sales of old office equipment will take place in Feb of \$ 1,100.
- Materials cost \$ 5 per unit. Materials are bought in the three months before being used in production and suppliers allow two months credit.
- All units are sold for \$25 each. Debtors are allowed two months credit.
- Variable overheads of \$2 is payable for every unit produced. This fee is paid in the month of produced.
- Rates are payable quarterly starting in February and \$ 700 of each quarter. (12 marks)

(b). A firm had produced the following budget at the beginning of the year;

Sales	10,000 units
	\$
Revenue	200,000
Materials	35,000
Labour	40,000
Variable Cost	17,500
Fixed Cost	60,000
Net Profit	47,500

At the end of the year the sales amount to 11,100 units and the selling price per unit had been \$ 21.50. The cost of materials were actually \$ 3.65 and Labour was \$ 3.90 per unit. Variable cost amounted to 16,800 and fixed cost were \$ 63,000.

Required: Devise a flexible budget for the actual sales volume and calculate the main variances.

(10 marks)

5.(a) Susan is managing director of a private limited company. She has recently capital outlay for new machine and equipments of \$ 510,000 [ to finance it as follows:

ordinary shares \$ 310,000 – cost of capital 20%

loan \$ 200,000 – cost of capital 12% ]

and also has additional payment for improve the existing production system of \$ 18,000 per annum for two years.

Department of Advanced Science and Technology  
University of Computer Studies

B.C.Sc. ( Third Year)  
CS - 306 ( Compiling Techniques + Operating System )  
First Term Examination

March 2013

**Answer All questions.**

**Time allowed : 3 hours.**

1. Discuss ANY FIVE of the following.
  - (a) Syntactic analysis
  - (b) Advantages and disadvantages of LL(1) parsing
  - (c) Chomsky hierarchy of language/grammar
  - (d) Non-context free language features
  - (e) Finite automaton
  - (f) Semantic definition
  - (g) Director symbol sets
  
2. (a)  $\begin{array}{ll} \langle \text{assign} \rangle & \rightarrow \langle F \rangle = \langle E \rangle \\ \langle E \rangle & \rightarrow \langle E \rangle + \langle T \rangle \mid \langle T \rangle \\ \langle T \rangle & \rightarrow \langle T \rangle * \langle F \rangle \mid \langle F \rangle \\ \langle F \rangle & \rightarrow (\langle E \rangle) \mid x \end{array}$ 

For the sentence,  $x=(x+x) *x$

  - (i) Give the left most derivation
  - (ii) Draw the parse tree using the above grammar.

(b) Produce the three address code for each of the following expression.

  - (i)  $a^*b/(-c)$
  - (ii)  $(a+b)^* c$
  
3. From the regular expression definition of real number  
 $(+ \mid - \mid ) d^* . d^*$ 
  - (a) Derive a finite automaton accepting a real number
  - (b) Write C code to recognise a real number based on the finite automaton
  
4. (a) ARRDEC  $\rightarrow$  TYPE space opbrac DLIST clbrac  
TYPE  $\rightarrow$  int | float  
DLIST  $\rightarrow$  d comma DLIST | d
  - (i) Prove the above grammar is not LL(1) grammar. Give reason for your answer
  - (ii) Transform the above grammar to LL(1) form.

(b) By forming the parsing table verify that the grammar with the following productions is LR(1) :

1.  $S \rightarrow axF$
2.  $F \rightarrow ,JF$
3.  $J \mid b$
4.  $J \rightarrow ax$
5.  $J \mid x$

5. Define **any four** on the followings:

- |                        |                    |                  |
|------------------------|--------------------|------------------|
| (a) Reusable resources | (b) Deadlock       | (c) Busy waiting |
| (d) Critical section   | (e) Weak semaphore |                  |

6. Write down **any four** on the followings:

- (a) Distinguish between Multiprogramming and Multiprocessing.
- (b) Interrupt disabling approach is one of the hardware approaches to guarantee the mutual exclusion but this approach has some disadvantages and describes these disadvantages. Why doesn't this approach work in multiprocessor architecture?
- (c) Describe the advantage of semaphore approach and the difficulty of that approach.
- (d) Describe the selection criteria to choose as a victim from the deadlocked processes that is aborted in order to recover from the deadlock?
- (e) List four relationships between senders and receivers. Describe in which relationships the association of processes to mailboxes can be static and also describe in which relationship the association of process to mailbox to be dynamic.

7. (a) Consider a system with a total of 200 units of memory, allocated to three processes shown:

Process	Max	Hold
1	90	70
2	70	40
3	60	50

Apply the banker's algorithm to determine whether it would be safe to grant each of the following requests. If yes, indicate a sequence of terminations that could be guaranteed possible. If no, show the reduction of the resulting allocation table.

- (i) A fourth process arrives, with a maximum memory need of 60 and an initial need of 25 units.
- (ii) A fourth process arrives, with a maximum memory need of 60 and an initial need of 35 units.
- (b) Consider the reader/writer problem using semaphore with the readers have priority. Describe the state of the process queues for the followings:
  - (a) The system has both readers and writers with the writer first
  - (b) The system has both readers and writers with the reader first

**Department of Advanced Science and Technology**  
**University of Computer Studies**  
**Third Year (B.C.Tech.)**  
**Mid-Term Examination**  
**Electronic I (CT 304)**  
**March, 2013**

**Answer all questions.**

**Time allowed: 3 hours**

- 1(a) Determine the voltage and current across the each diode in Figure 1(a-1) and (a-2) assuming that they are silicon diodes with a reverse resistance of  $47 \text{ M}\Omega$ .

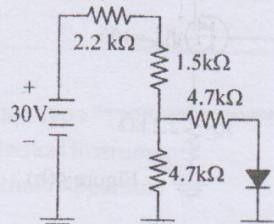


Figure 1(a-1)

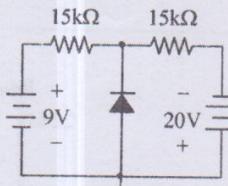


Figure 1(a-2)

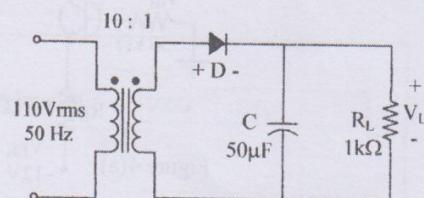


Figure 1(b)

- (b) Determine the ripple factor for the filtered half-wave rectifier in Figure 1(b).
- 2(a) Determine the output voltage for the diode limiter in Figure 2(a). Change the voltage divider to limit the output voltage to +6 V.

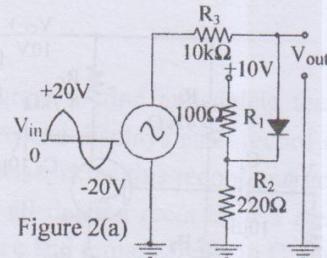


Figure 2(a)

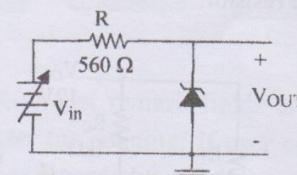


Figure 2(b)

- (b) Determine the minimum and maximum input voltages that can be regulated by the zener diode in Figure 2(b). Data for the zener diode:  $V_Z = 5.1\text{V}$  at  $I_{ZT} = 49\text{ mA}$ ,  $I_{ZK} = 1\text{mA}$ , and  $Z_Z = 7\Omega$  at  $I_{ZT}$ .
- 3(a) A base current of  $50\text{ }\mu\text{A}$  is applied to the transistor in Figure 3(a), and a voltage of  $5\text{ V}$  is dropped across  $R_C$ . Determine the  $\beta_{DC}$  of the transistor.

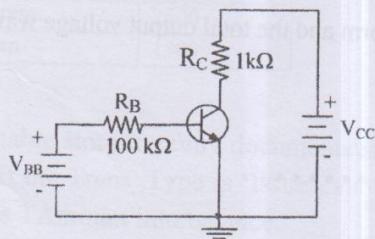


Figure 3(a)

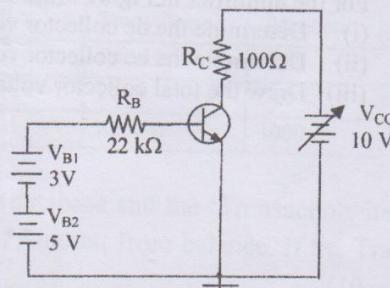


Figure 3(b)

- (b) The transistor in Figure 3(b) has the following maximum ratings:  $P_{D(\max)}=1000\text{mW}$ ,  $\beta_{DC}=150$ ,  $V_{CE(\max)}=15\text{V}$ , and  $I_{C(\max)}=200\text{mA}$ . Determine the maximum value to which  $V_{CC}$  can be adjusted without exceeding a rating. Which rating would be exceeded first?

- 4(a) Find  $I_C$ ,  $I_E$  and  $V_{CE}$  in Figure 4(a) for  $\beta_{DC}=100$ . Draw the dc load line showing the Q point. Determine how much Q-point will change over the temperature range where  $\beta_{DC}$  increases from 100 to 120 and  $V_{BE}$  decreases from 0.7V to 0.6V.

Ans  
1.

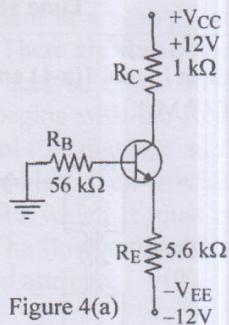


Figure 4(a)

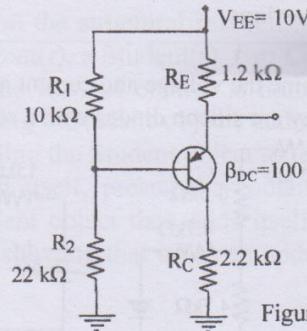


Figure 4(b)

- (b) Find  $I_C$  and  $V_{CE}$  in Figure 4(b). Determine whether or not this transistor is in saturation.  
 5(a) Select a minimum value for the emitter bypass capacitor,  $C_2$ , in Figure 5(a) if the amplifier must operate over a frequency range from 200 Hz to 10 kHz. Calculate the base-to-collector voltage gain of the amplifier both without and with an emitter bypass capacitor if there is no load resistor.

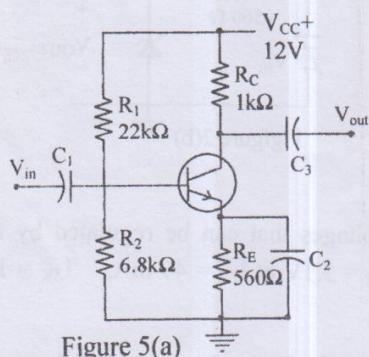


Figure 5(a)

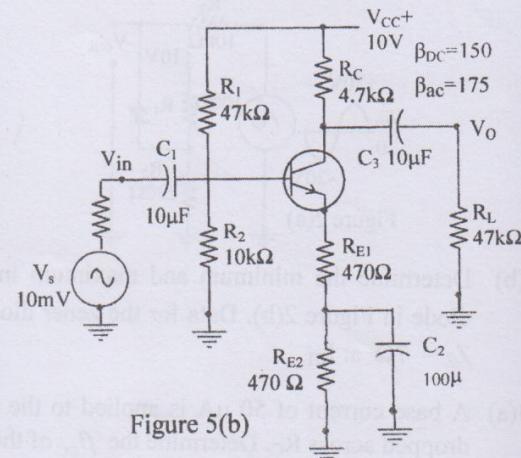


Figure 5(b)

- (b) For the amplifier in Figure 5(b),  
 (i) Determine the dc collector voltage.  
 (ii) Determine the ac collector voltage.  
 (iii) Draw the total collector voltage waveform and the total output voltage waveform.

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**Department of Advanced Science and Technology**

**University of Computer Studies**

**Third Year (B.C.Tech.)**

**Mid-Term Examination**

**Linear Control (CT 305)**

**March, 2013**

**Answer all questions.**

**Time allowed: 3 hours**

- 1(a) A laser jet printer uses a laser beam to print copy rapidly for a computer. The laser is positioned by a control input,  $r(t)$ , so that we have  $Y(s) = \frac{5(s+200)}{s^2 + 60s + 500} R(s)$ . The input  $r(t)$  represents the desired position of the laser beam.
- If  $r(t)$  is a unit step input, find the output  $y(t)$ .
  - What is the final value of  $y(t)$ ?

- (b) The transfer function of a system is

$$\frac{Y(s)}{R(s)} = \frac{10(s+3)}{s^2 + 11s + 30}$$

Determine  $y(t)$  when  $r(t)$  is unit step input.

- 2(a) A four-wheel antilock automobile braking system uses electronic feedback to control automatically the brake force on each wheel. A block diagram model of a brake control system is shown in Figure 2(a), where  $F_f(s)$  and  $F_R(s)$  are the braking force of the front and rear wheels, respectively, and  $R(s)$  is the desired automobile response on an icy road. Find  $F_f(s)/R(s)$ .

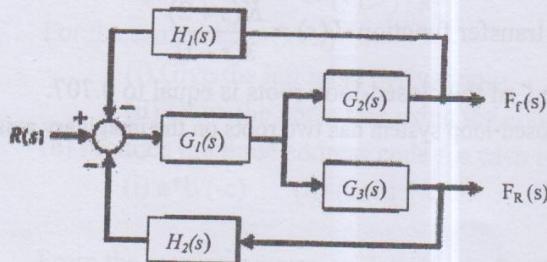


Figure 2(a)

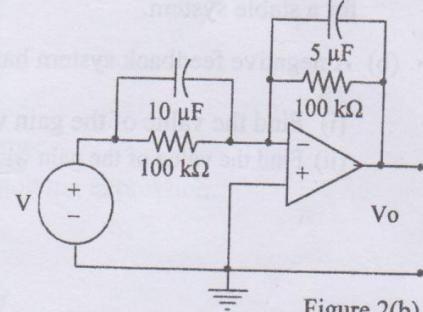


Figure 2(b)

- (b) Determine the transfer function,  $V_o(s)/V(s)$  for the op-amp circuit shown in Figure 2(b). Assume an ideal op amp.

- 3(a) A closed-loop system is used to track the sun to obtain maximum power from a photovoltaic array. The tracking system may be represented by Figure 3(a) with  $H(s)=1$  and  $G(s) = \frac{100}{\tau s + 1}$ , where  $\tau=3$  seconds nominally, (i) Calculate the sensitivity of this system for a small change in  $\tau$ . (ii) Calculate the time constant of the closed-loop system response:

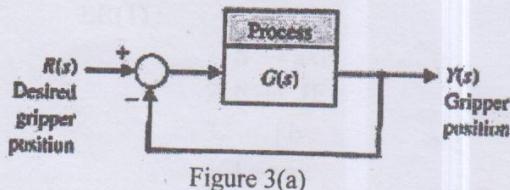


Figure 3(a)

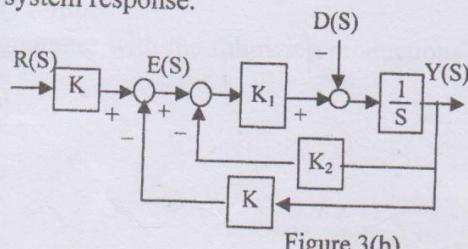


Figure 3(b)

- (b) Submersibles with clear plastic hulls have the potential to revolutionize underwater ~~lessons~~. One small submersible vehicle has a depth-control system as shown in Figure 3(b).
- Determine the sensitivity  $S_{K_1}^T$  and  $S_K^T$ .
  - Determine the closed-loop transfer function, and the steady-state error due to a disturbance  $D(S)=1/S$  and calculate the response  $y(t)$  for a step input  $R(S)=1/S$  when  $K=K_2=1$  and  $1 < K_1 < 10$ . Select  $K_1$  for the fastest response.
- 4(a) The engine, body, and tires of a racing vehicle affect the acceleration and speed ~~attainment~~. The speed control of the car is represented by the model shown in Figure 4(a). (i) Calculate the steady-state error of the car to a step command in speed, (ii) Calculate overshoot of the speed to a step command.

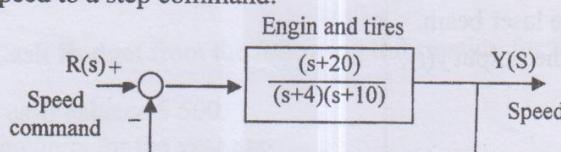


Figure 4(a)

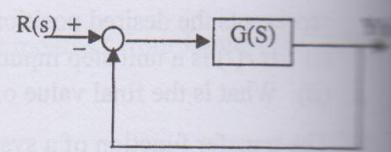


Figure 4(b)

- (b) A system is unity feedback is shown in Figure 4(b). Determine the steady-state error for a step and ramp input when

$$G(S) = \frac{10(s+4)}{S(S+1)(S+3)(S+8)}$$

- 5(a) A system has a characteristic equation  $s^3 + Ks^2 + (1+K)s + 6 = 0$ . Determine the range of  $K$  for a stable system.
- (b) A negative feedback system has a loop transfer function  $L(s) = \frac{K(s+2)}{s(s-1)}$
- Find the value of the gain when the  $\zeta$  of the closed-loop roots is equal to 0.707.
  - Find the value of the gain when the closed-loop system has two roots on the imaginary axis.

\* \* \* \* \*

**Department of Advanced Science and Technology**  
**University of Computer Studies**  
**Third Year (B.C.Tech.)**  
**Mid-Term Examination**  
**Electrical Circuits II (CT 306)**  
**March, 2013**

**Answer all questions.**

**Time allowed: 3 hours**

- 1.(a) After being in the configuration shown for a long time, the switch in figure 1(a) is opened at  $t=0$ . Determine value for  $i_x(0.5s)$ .
- (b) Find  $v_x(t)$  for all  $t$  in the circuit of figure 1(b).

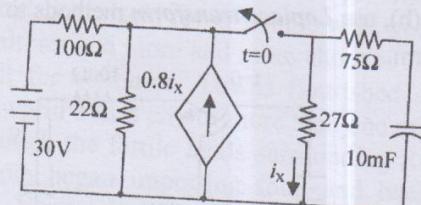


Fig-1(a)

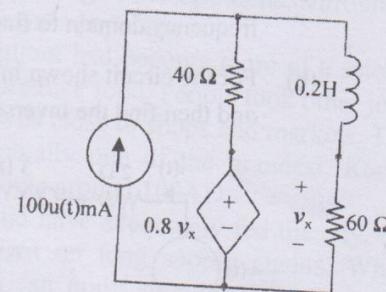


Fig-1(b)

- 2.(a) For the circuit of figure 2(a), find  $v_c(t)$  at  $t$  equal to (i)  $0^-$ ; (ii)  $0^+$ ; (iii)  $\alpha$ ; (iv)  $0.09$  s.
- (b) The switch in figure 2(b) was closed by the last crew aboard Mir before (at  $t=0$ ) it returned to earth. (i) Find  $i_A(0^-)$ , (ii) Find  $v_C(0^+)$ . (iii) Find the equivalent resistance in parallel with  $L$  and  $C$  for  $t>0$ . (iv) Find  $i_A(t)$ .

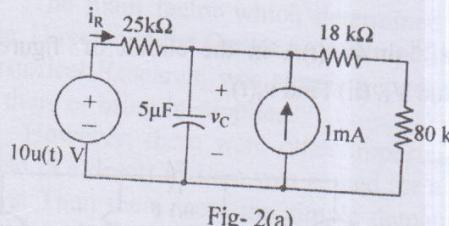


Fig- 2(a)

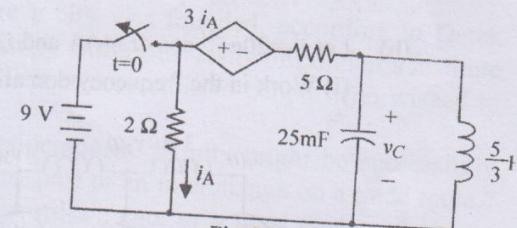


Fig-2(b)

- 3.(a) After being open for a long time, the switch in the circuit of figure 3(a) is closed at  $t=0$ . For  $t>0$ , find  $v_C(t)$  and  $i_{SW}(t)$ .

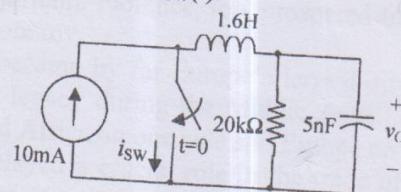


Fig-3(a)

- 3(b) The current source in the circuit of figure 3(b) suddenly increases from 15A to 22A at  $t=0$ . Find the voltage  $v_s(t)$  at  $t=3.5s$ .

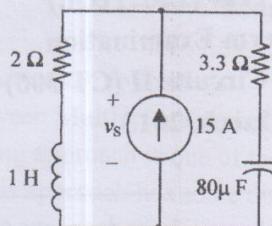


Fig- 3(b)

- 4.(a) Let  $v(t)=10e^{-2t} \cos(10t+30^\circ)$  V in the circuit shown in figure 4(a), and work in the frequency domain to find (i)  $I$ , (ii)  $i(t)$
- (b) For the circuit shown in figure 4(b), use **Laplace transform** methods to solve for  $I_C(s)$  and then find the inverse transform.

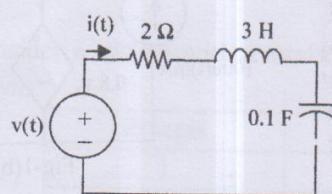


Fig- 4(a)

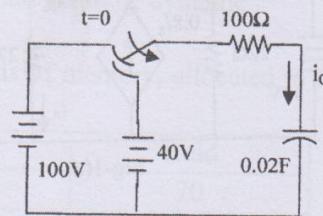


Fig- 4(b)

- 5.(a) Use **nodal analysis** to determine the voltages  $v_1$ ,  $v_2$ ,  $v_3$  in the circuit of figure 5(a). Assume there is zero energy stored in the inductors at  $t=0^-$ .
- (b) Let  $i_{s1}=20e^{-3t} \cos 4t u(t)$ A and  $i_{s2}=30e^{-3t} \sin 4t u(t)$ A in the circuit of figure 5(b). (i) Work in the frequency domain to find  $\mathbf{V}_x$ . (ii) Find  $v_x(t)$ .

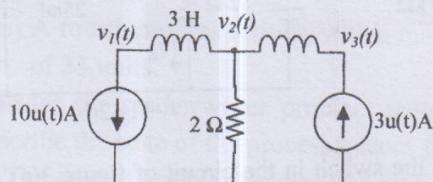


Fig-5(a)

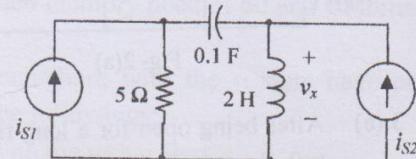


Fig-5(b)