

Tutorial Letter 101/0/2024

Theoretical Computer Science III COS3701

Year Module

Department of Computer Science

IMPORTANT INFORMATION

Please register on myUnisa, activate your myLife e-mail account and make sure that you have regular access to the myUnisa module website, COS3701-24-Y, as well as your group website.

Note: This is a fully online module. It is, therefore, only available on myUnisa.

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1. INTRODUCTION

Dear Student

Unisa is a comprehensive open distance e-learning (CODEL) higher education institution. The comprehensiveness of our curricula encapsulates a range of offerings, from strictly vocational to strictly academic certificates, diplomas and degrees. Unisa's "openness" and its distance eLearning character result in many students registering at Unisa who may not have had an opportunity to enrol in higher education. Our CODEL character implies that our programmes are carefully planned and structured to ensure success for students ranging from the under-prepared but with potential to the sufficiently prepared.

Teaching and learning in a CODEL context involves multiple modes of delivery ranging from blended learning to fully online. As a default position, all post graduate programmes are offered fully online with no printed study materials, while undergraduate programmes are offered in a blended mode of delivery where printed study materials are augmented with online teaching and learning via the learner management system – myUnisa. In some instances, undergraduate programmes are offered fully online as well.

Furthermore, our programmes are aligned with the vision, mission and values of the University. Unisa's commitment to serve humanity and shape futures combined with a clear appreciation of our location on the African continent, Unisa's graduates have distinctive graduate qualities which include

- independent, resilient, responsible and caring citizens who are able to fulfil and serve in multiple roles in their immediate and future local, national and global communities
- having a critical understanding of their location on the African continent with its histories, challenges and potential in relation to globally diverse contexts
- the ability to critically analyse and evaluate the credibility and usefulness of information and data from multiple sources in a globalised world with its ever-increasing information and data flows and competing worldviews
- how to apply their discipline-specific knowledges competently, ethically and creatively to solve real-life problems
- an awareness of their own learning and developmental needs and future potential

This is a blended module (that is, it has some printed and some online material), you need to use myUnisa to study and complete the learning activities for this module. Whether a module is offered either as blended (meaning that we use a combination of printed and online material to engage with you) or online (all information is available via the internet), we use myUnisa as our virtual campus. This is an online system that is used to administer, document and deliver educational material to you and support engagement with you. Look out for information from your lecturer as well as other Unisa platforms to determine how to access the virtual myUnisa module site. Information on the tools that will be available to engage with the lecturer and fellow students to support your learning will also be communicated via various platforms.

Whether a module is offered either as blended (meaning that we use a combination of printed and online material to engage with you) or online (all information is available via the internet), we use myUnisa as our virtual campus. This is an online system that is used to administer, document and deliver educational material to you and support engagement with you. Look out for information from your lecturer as well as other Unisa platforms to determine how to access the virtual myUnisa module site. Information on the tools that will be available to engage with the lecturer and fellow students to support your learning will also be communicated via various platforms.

You are encouraged to log into the module site on myUnisa regularly (that is COS3701-2024-Y, at least twice per week).

All study material for this module will be available on myUnisa. It is thus very important that you register on myUnisa and access the module site on a regular basis. You must be registered on myUnisa to be able to access your learning material, submit your assignments, gain access to various learning resources, “chat” to your lecturer/e-tutor and fellow students about your studies and the challenges that you might encounter, and to participate in online discussion forums.

We wish you every success with your studies!

2. MODULE OVERVIEW

2.1 Purpose

Students who have completed this module successfully will be able to generate recursive enumerable languages, context free languages as well as Push Down Automata (PDAs) which accept Context Free Grammars (CFGs). There are Two types of machines namely, nPDAs ($n > 1$) and Turing Machines (TMs), which accept a variety of formal languages, including recursive enumerable languages. If you understand TMs, the theoretical predecessor of the computer, then you should start to realize what is computable and what not. The Chomsky hierarchy is presented to provide an overview of formal languages.

2.2 Outcomes

For this module, you will have to master several outcomes:

- **Specific outcome 1:** Define context free grammars (as formal mathematical presentations), using a variety of defined mathematical tools for evidence (including definitions, theorems and operators).
- **Specific outcome 2:** Construct mathematical proofs concisely using abstract mathematical reasoning techniques. Types of proofs include proofs by constructive algorithms, direct proofs, proofs by machines, proofs by decidability algorithms and proofs by reductio ad absurdum (pumping lemma).
- **Specific outcome 3:** Construct context free language (CFL – Type 2 grammars, Chomsky Hierarchy) machine acceptors, by drawing these machine acceptors, namely Push Down Automata (PDAs), through applying the relevant definitions and theorems.

- **Specific outcome 4:** Construct Turing Machines and nPDAs for n greater than 1, which accept context sensitive grammars (Type 1 grammars, Chomsky Hierarchy) and recursive enumerable languages (Type 0 grammars, Chomsky Hierarchy).
- **Specific outcome 5:** Critically analyse and synthesise provided TMs to determine which languages are accepted by them.
- **Specific outcome 6:** Perform algorithms on CFGs to obtain a product, sum or Kleene closure of a maximum of two CFGs in the case of the sum and the product and one CFG in the case of the Kleene closure. Proving thereby, for specific CFLs, that they are closed under the product, sum and Kleene closure. In general, it is proven in Cohen that all CFLs are closed under the product, sum and Kleene closure.

3. CURRICULUM TRANSFORMATION

Unisa has implemented a transformation charter, in terms of which the university has placed curriculum transformation high on the teaching and learning agenda. Curriculum transformation includes student-centred scholarship, the pedagogical renewal of teaching and assessment practices, the scholarship of teaching and learning, and the infusion of African epistemologies and philosophies. All of these will be phased in at both programme and module levels, and as a result of this you will notice a marked change in the teaching and learning strategy implemented by Unisa, together with the way in which the content is conceptualised in your modules. We encourage you to embrace these changes during your studies at Unisa in a responsive way within the framework of transformation.

4. LECTURER(S) AND CONTACT DETAILS

4.1 Lecturer(s)

The primary lecturer for this module is Ms Daphney Rakoti Mokwana:

Department: Computer Science

Telephone: 0116709134

E-mail: mokwadr@unisa.ac.za

4.2 Department

You can contact the Department of Computer Science as follows:

Telephone number: 011 670 9200

E-mail: computing@unisa.ac.za

4.3 University

Contact addresses of the various administrative departments appear on the Unisa website: <http://www.unisa.ac.za/sites/corporate/default/Contact-us/Student-enquiries>.

Please include the student number in all correspondence

5. RESOURCES

5.1 Prescribed book(s)

COHEN, DANIEL I.A. Introduction to Computer Theory, 2nd edition. John Wiley & Sons, 1997.

Note that there is a custom version of the textbook which was printed specially for the COS2601 and COS3701 Unisa modules. That version is equivalent to the normal 2nd Edition.

We cover Parts II and III of the textbook. The textbook is available from the official university booksellers and you are required to obtain your own copy. Please consult the list of official booksellers and their addresses in Study @ Unisa. If you have any difficulties with obtaining books from these bookshops, please contact the Registrar as soon as possible. Note that Cohen is prescribed for COS2601 too, thus you probably have a copy of the book already.

Section	Cohen, 1997 edition
1	Chapter 12 - 15
2	Chapter 16 - 18
3	Chapter 19 - 22
4	Chapter 23 - 25

Parts of these chapters are not prescribed, and one whole chapter – Chapter 20 (1997 edition) can be omitted.

5.2 Recommended book

Should you wish to know more about a particular topic, you may consult the following book.

MARTIN, J. Introduction to Languages and the Theory of Computation. 3rd edition. McGraw-Hill, 2003.

(Please note that this book is not necessarily included in the study collection of the Unisa library.)

Recommended books can be requested online, via the library catalogue.

5.3 Electronic reserves (e-reserves)

E-reserves can be downloaded from the library webpage. More information is available at: <http://libguides.unisa.ac.za/request/request>

5.4 Library services and resources

The Unisa Library offers a range of information services and resources. The library has created numerous library guides, available at <http://libguides.unisa.ac.za>

Recommended guides:

- For brief information on the library, go to <https://www.unisa.ac.za/library/libatglance>
- For more detailed library information, go to <http://www.unisa.ac.za/sites/corporate/default/Library>
- Frequently Asked Questions, visit <https://www.unisa.ac.za/sites/corporate/default/Library/Frequently-Asked-Questions>
- For research support and services such as the Personal Librarian service and the Information Search Librarian's Literature Search Request (on your research topic) service, visit <http://www.unisa.ac.za/sites/corporate/default/Library/Library-services/Research-support>.
- For library training for undergraduate students, visit <https://www.unisa.ac.za/sites/corporate/default/Library/Library-services/Training>
- Lending Services <https://www.unisa.ac.za/sites/corporate/default/Library/Library-services/Lending-services>
- Services for Postgraduate students - <https://www.unisa.ac.za/sites/corporate/default/Library/Services-for-Postgraduates>
- Support and Services for students with disabilities
- <https://www.unisa.ac.za/sites/corporate/default/Library/Services-for-students-withspecial-needs>
- Library Technology Support - <https://libguides.unisa.ac.za/techsupport>
- Finding and using library resources and tools - http://libguides.unisa.ac.za/Research_skills
- A–Z list of library databases – <https://libguides.unisa.ac.za/az.php>

Important contact information:

- Technical problems encountered in accessing library online services: Lib-help@unisa.ac.za
- General library-related queries: Library-enquiries@unisa.ac.za
- Queries related to library fines and payments: Library-fines@unisa.ac.za
- Interlibrary loan service for postgraduate students: libr-ill@unisa.ac.za
- Literature Search Service: Lib-search@unisa.ac.za
- Social media channels: Facebook: UnisaLibrary and Twitter: @UnisaLibrary

6. STUDENT SUPPORT SERVICES

The *Study @ Unisa* brochure is available on myUnisa: www.unisa.ac.za/brochures/studies

This brochure contains important information and guidelines for successful studies through Unisa. If you need assistance with regard to the myModules system, you are welcome to use the following contact details:

- Toll-free landline: 0800 00 1870 (Select option 07 for myModules)
- E-mail: mymodules22@unisa.ac.za or myUnisaHelp@unisa.ac.za

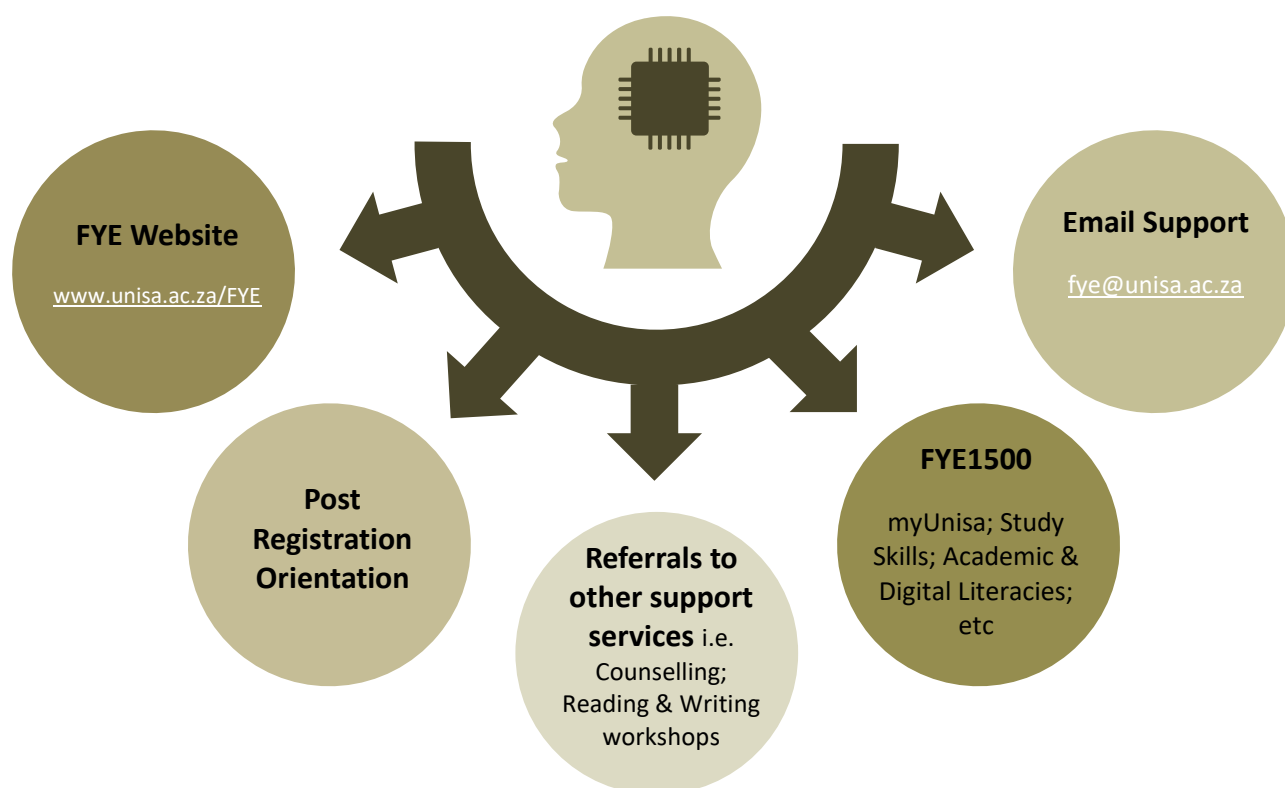
You can access and view short videos on topics such as how to view your calendar, how to access module content, how to view announcements for modules, how to submit assessment and how to participate in forum activities via the following link: <https://dtls-ga.unisa.ac.za/course/view.php?id=32130>

Registered Unisa students get a free myLife e-mail account. Important information, notices and updates are sent exclusively to this account. Please note that it can take up to 24 hours for your account to be activated after you have claimed it. Please do this immediately after registering at Unisa, by following this link: myLifeHelp@unisa.ac.za

Your myLife account is the **only** e-mail account recognised by Unisa for official correspondence with the university and will remain the official primary e-mail address on record at Unisa. You remain responsible for the management of this e-mail account.

6.1 First-Year Experience Programme

Many students find the transition from school education to tertiary education stressful. This is also true in the case of students enrolling at Unisa for the first time. Unisa is a dedicated open distance and e-learning institution, and it is very different from face-to-face/contact institutions. It is a mega university, and all our programmes are offered through either blended learning or fully online learning. It is for this reason that we thought it necessary to offer first-time students additional/extended support to help them seamlessly navigate the Unisa teaching and learning journey with little difficulty and few barriers. We therefore offer a specialised student support programme to students enrolling at Unisa for the first time – this is Unisa’s First-Year Experience (FYE) Programme, designed to provide you with prompt and helpful information about services that the institution offers and how you can access information. The following FYE services are currently offered:



💡 To ensure that you do not miss out on important academic and support communication from the SRU, please check your myLife inbox regularly.

7. STUDY PLAN

Work to do
Revision of COS2601 Material
Chapter 12 – Context free grammars
Chapter 13 – Grammatical Format
Chapter 14 – Pushdown Automata
Chapter 15 – CFG = PDA
Chapter 16 – Non-context Free Languages complete assignment 1
Chapter 17 – Context Free Languages
Chapter 18 – Decideability
Chapters 19 – Turing Machines Complete assignment 2
Chapter 21 – Minsky's Theorem
Chapter 22 – Variations on the TM
Chapters 23 and 24 – TM Languages & The Chomsky Hierarchy
Chapters 24 and 25 – The Chomsky Hierarchy & Computers Complete assignment 3
Revision Exams commence. Revision until exam date.

8. HOW TO STUDY ONLINE

8.1 What does it mean to study fully online?

Studying online is a method of education whereby students learn in a fully virtual environment. All your study material is and learning activities for online modules are designed to be delivered online on myUnisa. All your assessments must be submitted online on myUnisa.

9. ASSESSMENT

9.1 Assessment criteria

The formative assessment in this module will be four individual written assignments numbered 01, 02 and 03.

The material covered in these assessments will be covered in the examination.

The summative assessment for this module is in the form of a take home examination, which will take place at the end of the year.

9.2 Assessment plan

- To complete this module, you will be required to submit Three assessments.
- All information about when and where to submit your assessments will be made available to you via the myModules site for your module.
- Due dates for assessments, as well as the actual assessments are available on the myModules site for this module.

- To gain admission to the examination, you will be required to submit One assignment.
- To gain admission to the examination, you need to obtain a year mark average of 40% for the assignments.
- The assignment weighting for the module is 20%.
- You will receive examination information via the myModules sites. Please watch out for announcements on how examinations for the modules for which you are registered will be conducted.
- The examination will count 80% towards the final module mark.

9.3 Assessment due dates

- There are no assignment **due dates** included in this tutorial letter.
- Assignment due dates will be made available to you on the myUnisa landing page for this module. We envisage that the due dates will be available to you upon registration.
- Please start working on your assessments as soon as you register for the module.
- Log on to the myUnisa site for this module to obtain more information on the due dates for the submission of the assessments.

9.4 Submission of assessments

- Unisa, as a comprehensive open distance e-learning institution (CODEL), is moving towards becoming an online institution. You will therefore see that all your study material, assessments and engagements with your lecturer and fellow students will take place online. We use myUnisa as our virtual campus.
- The myUnisa virtual campus will offer students access to the myModules site, where learning material will be available online and where assessments should be completed. This is an online system that is used to administer, document, and deliver educational material to students and support engagement between academics and students.
- The myUnisa platform can be accessed via <https://my.unisa.ac.za>. Click on the myModules 2024 button to access the online sites for the modules that you are registered for.
- The university undertakes to communicate clearly and as frequently as is necessary to ensure that you obtain the greatest benefit from the use of the myModules learning management system. Please access the announcements on your myModules site regularly, as this is where your lecturer will post important information to be shared with you.
- When you access your myModules site for the module/s you are registered for, you will see a welcome message posted by your lecturer. Below the welcome message you will see the assessment shells for the assessments that you need to complete. Some assessments may be multiple choice, some tests, others written assessments, some forum discussions, and so on. All assessments must be completed on the assessment shells available on the respective module platforms.

- To complete quiz assessments, please log on to the module site where you need to complete the assessment. Click on the relevant assessment shell (Assessment 1, Assessment 2, etc.). There will be a date on which the assessment will open for you. When the assessment is open, access the quiz online and complete it within the time available to you. Quiz assessment questions are not included in this tutorial letter (Tutorial Letter 101) and are only made available online. You must therefore access the quiz online and complete it online where the quiz has been created.
- It is not advisable to use a cell phone to complete the quiz. Please use a desktop computer, tablet or laptop when completing the quiz. Students who use a cell phone find it difficult to navigate the **Online Assessment** tool on the small screen and often struggle to navigate between questions and successfully complete the quizzes. In addition, cell phones are more vulnerable to dropped internet connections than other devices. **If at all possible, please do not use a cell phone for this assessment type.**
- For written assessments, please note the due date by which the assessment must be submitted. Ensure that you follow the guidelines given by your lecturer to complete the assessment. Click on the submission button on the relevant assessment shell on myModules. You will then be able to upload your written assessment on the myModules site of the modules that you are registered for. Before you finalise the upload, double check that you have selected the correct file for upload. Remember, no marks can be allocated for incorrectly submitted assessments.

9.4.1 Types of assignments and descriptions

All assignments are defined as either optional, mandatory, compulsory, or elective.

- **Elective assignments**
 - If not submitted, the student gets no mark for this item.
 - The best of the required submissions will count.
- **Mandatory assignments**
 - If not submitted, the student gets no mark for this item.
- **Compulsory assignments**
 - If not submitted, the result on the student's academic record will be *absent*.
- **Optional assignments** – You are encouraged as a student to do optional assignment so that it may benefit your learning.

I. Elective assignments

- a. the student is given a choice of which assignments within an identified group to submit, only the best result(-s), the number of which is specified in advance, will contribute towards the year mark.
- b. elective assignments must also be grouped into an elective group.
- c. for the student to select which assignment to submit, the elective assignments must be grouped together. For such an elective group, relevant information must be provided to the student, such as how many of the assignments must be submitted and how many of the assignment marks should be combined into the year mark.
- d. The selection criteria define how marks received for assignments in an elective group are to be combined into the year mark. Three different criteria may be used for calculating the year mark:

- The best mark should be used, or
- If the student submits fewer than the required number of assignments per group or no assignment in a group, a mark of 0% will be used.
- 0% is awarded to all non-submitted or unmarked assessments. A best mark is then calculated from all items.

II. Mandatory assignments

- contribute to the year mark.
- If a student fails to submit a mandatory assignment, no mark is awarded and the year mark is calculated accordingly. The student will therefore forfeit the marks attached to this assignment when the final mark for the module is calculated.

III. Compulsory Assessment

- when not submitted, the student will fail a Continuous Assessment module but will be shown as absent from the examination in the case of other modules.

- Optional assignments** – You are encouraged as a student to do optional assignment so that it may benefit your learning.

9.5 The assessments

As indicated in section 9.2, you need to complete Three assessments for this module. Details on the module website, COS3701-24-Y.

9.6 Other assessment methods

Look out for assessment information that will be shared with you by your lecturer and e-tutors (where relevant) and for communication from the university.

9.7 The examination

Examination information and details on the format of the examination will be made available to you online via the myUnisa site. Look out for information that will be shared with you by your lecturer and e-tutors (where relevant) and for communication from the university.

9.7.1 Invigilation/proctoring

Since 2020 Unisa conducts all its assessments online. Given stringent requirements from professional bodies and increased solicitations of Unisa's students by third parties to unlawfully assist them with the completion of assignments and examinations, the University is obliged to assure its assessment integrity through the utilisation of various proctoring tools: Turnitin, Moodle Proctoring, the Invigilator App and IRIS. These tools will authenticate the student's identity and flag suspicious behaviour to assure credibility of students' responses during assessments. The description below is for your benefit as you may encounter any or all of these in your registered modules:

Turnitin is a plagiarism software that facilitates checks for originality in students' submissions against internal and external sources. Turnitin assists in identifying academic fraud and ghost writing. Students are expected to submit **typed** responses for utilisation of the Turnitin software.

The **Moodle Proctoring tool** is a facial recognition software that authenticates students' identity during their Quiz assessments. This tool requires access to a student's **mobile or laptop camera**. Students must ensure their camera is activated in their browser settings prior to their assessments.

The **Invigilator "mobile application-based service"** does verification of the identity of an assessment participant. The Invigilator Mobile Application detects student dishonesty-by-proxy and ensures that the assessment participant is the registered student. This invigilation tool requires students to download the app from their Play Store (Google, Huawei and Apple) on their **mobile devices** (camera enabled) prior to their assessment.

IRIS Invigilation software verifies the identity of a student during assessment and provides for both manual and automated facial verification. It has the ability to record and review a student's assessment session. It flags suspicious behaviour by the students for review by an academic administrator. IRIS software requires installation on students' **laptop devices** that are enabled with a webcam.

Students who are identified and flagged for suspicious dishonest behaviour arising from the invigilation and proctoring reports are referred to the disciplinary office for formal proceeding.

Please note:

Students must refer to their module assessment information on their myModule sites to determine which proctoring or invigilation tool will be utilised for their formative and summative assessments.

10. ACADEMIC DISHONESTY

10.1 Plagiarism

Plagiarism is the act of taking the words, ideas and thoughts of others and presenting them as your own. It is a form of theft. Plagiarism includes the following forms of academic dishonesty:

- Copying and pasting from any source without acknowledging the source.
- Not including references or deliberately inserting incorrect bibliographic information.
- Paraphrasing without acknowledging the original source of the information.

10.2 Cheating

Cheating includes, but is not limited to, the following:

- Completing assessments on behalf of another student, copying the work of another student during an assessment, or allowing another student to copy your work.
- Using social media (e.g. WhatsApp, Telegram) or other platforms to disseminate assessment information.
- Submitting corrupt or irrelevant files, this forms part of examination guidelines
- Buying completed answers from so-called "tutors" or internet sites (contract cheating).

10.3 For more information about plagiarism, follow the link below:

<https://www.unisa.ac.za/sites/myunisa/default/Study-@-Unisa/Student-values-and-rules>

11. STUDENTS LIVING WITH DISABILITIES

The Advocacy and Resource Centre for Students with Disabilities (ARCSWiD) provides an opportunity for staff to interact with first-time and returning students with disabilities.

If you are a student with a disability and would like additional support or need additional time for assessments, you are invited to contact (name and e-mail address of the lecturer must be inserted) to discuss the assistance that you need.

12. FREQUENTLY ASKED QUESTIONS

None

13. SOURCES CONSULTED

The prescribed textbook and Unisa policy documents

14. IN CLOSING

Do not hesitate to contact your lecturers by email if you are experiencing problems with the content of this tutorial letter or any aspect of the module.

The COS3701 lecturers hope that you will enjoy the module and wish you success. Note that your success depends on your own efforts – work hard, do your assignments, etc. and you are much more likely to be successful.

15. ADDENDUM

There are no addenda.

ANNEXURE: GLOSSARY OF TERM

No glossary.