VAAL UNIVERSITY
OF TECHNOLOGY

APPLIED & COMPUTER SCIENCES

Prospectus

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Copies of the Faculty Prospectus are obtainable from:

The Registrar
Office: CW Building
Tel: +27 (16) 950 9930
Fax: +27 (16) 950 9775

NB:

Although the information contained in this Faculty Prospectus has been compiled as accurately as possible, the Council and the Senate of the Vaal University of Technology accept no responsibility for any errors or omissions.

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1. Welcoming by the Executive Dean

As Executive Dean of the Faculty of Applied & Computer Sciences, I extend a very special welcome to you. Congratulations on being accepted into the Science programs.

All our dedicated staff members are committed to excellence in teaching, research and community engagement. The Faculty comprises seven excellent departments. Our large and diverse departments welcome applications for undergraduate and postgraduate study from individuals from SADC, AU community and all overseas countries.

Our courses are constantly recognized as among the best in South Africa and we are proud of our reputation we have gained for innovation. Our unique curricula also emphasize experience in the workplace which we achieve through class consulting projects, simulations, Work Integrated Learning (WIL) and mentor programs.

Our programs are underpinned by research informed evidence drawn from the work of our own staff and industry. Our qualifications are also informed by the experience of dedicated academic staff so that what you learn relates to real situations.

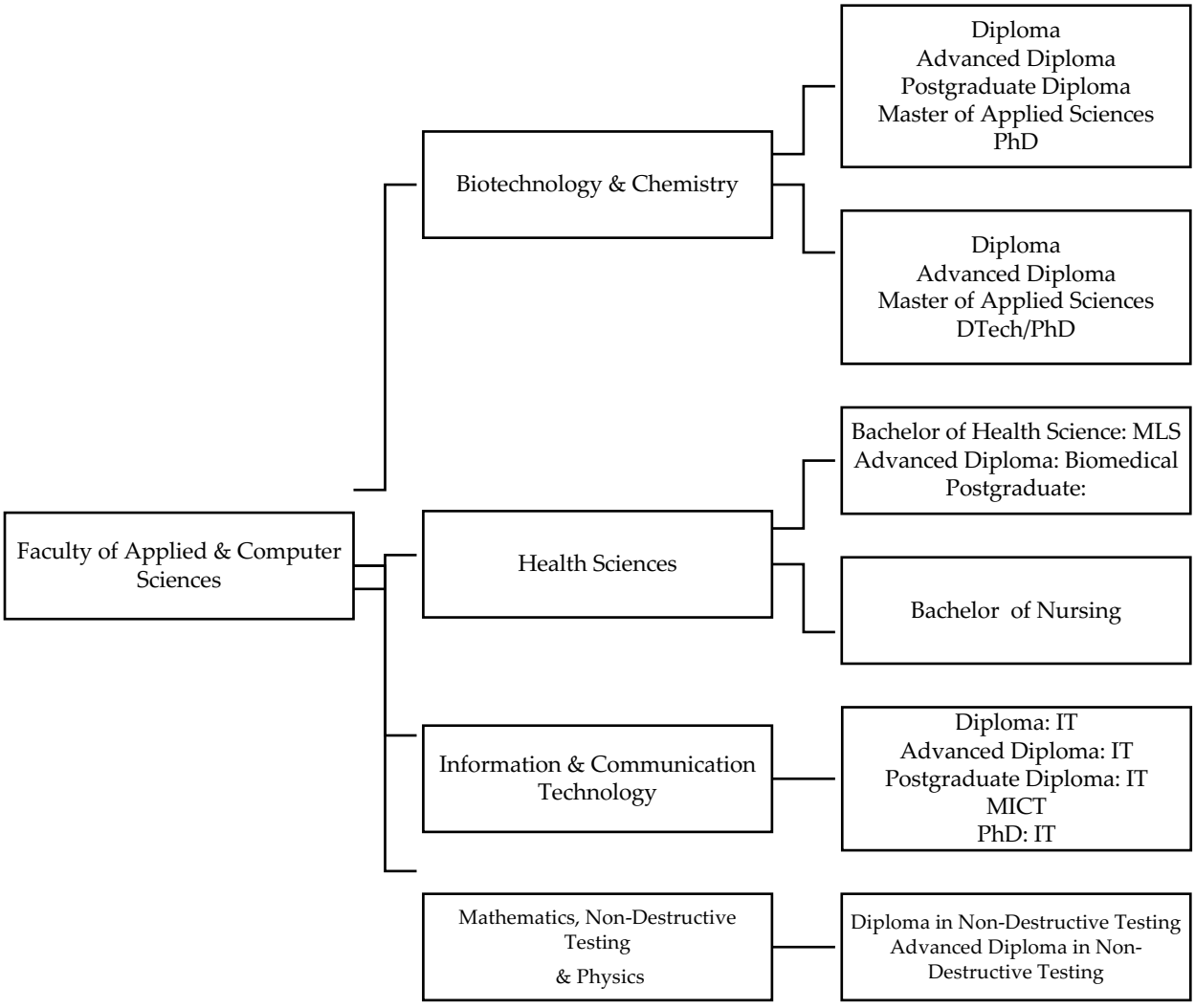
Our graduates can be found in almost all walks of industrial, community, professional and business life.

We are committed to ensuring that you have a satisfying experience studying in this Science faculty. We also want to encourage a lifelong love of ideas, discovery and learning, your ability to work independently and in collaboration with others. We are committed to intellectual integrity and curiosity.

I look forward to you working with us and wish you well on what will be a worthwhile journey.

Prof BR Mabuza (PhD)
Executive Dean

2. Departmental Structure of Qualifications



3. Department of Biotechnology & Chemistry

3.1. Biotechnology Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Modise, SJ (Prof)	HOD	PhD
Walmsley, TA (Dr)	Senior Lecturer	PhD
Vacant	Administrator	
Padayachee, T (Prof)	Professor	DTech
Feto, N (Dr)	Senior Lecturer	PhD
Baburam, C (Dr)	Lecturer	Phd
Laloo, N (Mr)	Lecturer	MSc
Marrengane, Z (Ms)	Lecturer	MTech
Manzi, S (Mr)	Lecturer	MTech
Terblanche, U (Dr)	Lecturer	PhD
Mphuthi, BR (Ms)	Technician	MTech
Mohlala, G (Mr)	Technician	BTech
Mokgope, H (Mr)	Technician	MTech
Takaidza, S (Dr)	Senior Technologist	PhD
Thathana, MG (Mr)	Technologist	MTech
Viljoen, S (Ms)	Technician	BSc

3.2. Diploma

Four semesters of class attendance at the University, plus two semesters Workplace Integrated Learning.

The Functions of a Microbiologist / Biotechnologist

The Biotechnology Department strives to shape technicians, academics and researchers that will develop and support sustainable and integrated biotechnology that improves life for all the living world.

Career Opportunities

A career as a Microbiologist / Biotechnologist offers challenging and exciting opportunities including quality control in enterprises such as: water purification plants, food processing factories, dairies, pharmaceutical factories, sewerage plants etc. There is a demand for trained Microbiologists / Biotechnologists in industrial, research and academic settings.

Entry level : Laboratory Assistant

Middle level : Laboratory Technician

Top level : Laboratory Manager

Research opportunities are available at academic, industrial and research institutions.

Admission Requirements:

National Senior Certificate (NSC) Entry Requirements:

Subjects	National Diploma: Biotechnology	Note
NSC Endorsement:	Eligibility for Diploma, or Bachelors' degree	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69%
Compulsory Subjects: Physical Science Mathematics English Life Science	 4 4 4 4	
Life Orientation	Max 3	
Any other 2 Subjects	7	
TOTAL	26	

Senior Certificate (SC) Entry Requirements:
Compulsory subjects (with minimum requirements)
Mathematics and Physical Sciences HG (D) or SG (C) and English HG (E) or SG (D)

Bonus Points
Mathematics and Physical Sciences HG 2, SG 1
Bonus points only allocated for HG (D) and SG (C) and higher symbols.
Minimum points required for this course is 26.

National Certificate (Vocational) (NC (V)) Entry Requirements:
N/A
Recognition of Prior Learning (RPL):
Application with a Senior Certificate and a minimum of 5 years related laboratory experience will be considered for Diploma: Biotechnology.

Curriculum

Semester 1	Semester 2
• Microbiology I Theory • Microbiology I Practical • Chemistry I • Biodiversity and Ecology • Calculations & Statistics I • Communication Skills I (Module I)	• Microbiology II Theory • Microbiology II Practical • Biochemistry II Theory • Biochemistry II Practical • Analytical Chemistry: Biological II • Disease and Immune Response II • Basic Computer Skills • Communication Skills I (Module 2)
Semester 3	**Semester 4**
• Microbiology III Theory • Microbiology III Practical • Introductory Genetics II • Microbial Biochemistry III Theory	• Food Microbiology III Theory • Food Microbiology III Practical • Analytical Biochemistry III • Quality Assurance I (Biological)

• Microbial Biochemistry III Practical • Fermentation Technology II Theory • Fermentation Technology II Practical • Communication Skills II (Module I)	• Bioprocessing III Theory • Bioprocessing III Practical • Entrepreneurship • Communication Skills II (Module II)
Semester 5	**Semester 6**
• Biotechnology Laboratory Practice I	• Biotechnology Laboratory Practice II

Assessment

Assessment takes the form of written examinations for Theory subjects and CASS for practical subjects.

Articulation Options

Students who have completed the Diploma can move on to an Advanced Diploma in Biotechnology. The purpose of the qualification is to develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent practicing Biotechnologist. It is intended to empower candidate Biotechnologists to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes and values in the work environments in South Africa. It is also designed to add value to the qualifying student in terms of enrichment of the person, status and recognition. The Advanced Diploma in Biotechnology is required for articulation into the Postgraduate Diploma in Biotechnology which provides students with the research skills required to then articulate into Master of Applied Sciences in Biotechnology and finally a PhD in Biotechnology.

3.3. Advanced Diploma: Biotechnology

Admission Requirements:

- Diploma: Biotechnology or equivalent relevant NQF level 6, 360 credit qualification.
- 60% average on all third-year subjects not a requirement.

Must have passed all subjects first time.

Duration:

This is a one-year full-time course.

Curriculum:

Semester 1	Semester 2
• Green Biotechnology • Molecular Biology • Research Methodology • Biotechniques (Year Course)	• Laboratory Management and Compliance • White Biotechnology • Advanced Microbial Biochemistry • Biotechniques (Year Course)

3.4. Postgraduate Diploma: Biotechnology

Admission Requirements:

Advanced Diploma in Biotechnology (or relevant field), BSc Hons (in relevant field)

(NB: It is imperative that those students wishing to apply for Postgraduate Diploma, have successfully completed the Advanced Diploma programme an overall average mark of 60%

Duration:

This is a one year full-time course.

Curriculum:

Semester 1	Semester 2
• Advanced Molecular Biology • Bioinformatics Module1 • Advanced Biotechnology Module 1 • Research Project (Year Course	• Bioinformatics Module 2 • Biostatistics • Advanced Biotechnology Module 2 • Research Project (Year Course)

3.5. Master of Applied Science in Biotechnology

Admission Requirements:

A Postgraduate Diploma, BSC Hons or equivalent (in a relevant field of study with an overall average of 60%. As this degree is based on research, all candidates shall submit the following-

a) Proof of successful completion of a course in Research Methodology; and

b) A research proposal for approval by the Executive Committee of Senate (the research proposal is submitted once the Masters candidate has secured a position within a research group and has written a proposal in consultation with their supervisor).

Duration:

The equivalent of at least two years full-time study.

Curriculum:

This instructional programme comprises of a dissertation only, provided that the student has already passed a course in Research Methodology.

In their dissertations students must prove that they understand a particular problem in the discipline in which they have done research. Students must prove that they are able to analyse and set out the problem logically, are able to arrive at logical conclusions or a diagnosis and are then able to make proposals on the improvement / elimination of the problem. The dissertation must comply with the general technical requirements and rules with regards to scope, quality and format.

3.6. PhD: Biotechnology

Admission requirements:

- NQF level 9 related qualification with a minimum of 180 credits.
  60% average not a requirement

Biotechnology Laboratory Practice I and II

The structured theoretical education and the Work Integrated Learning partnership, as offered by the University and the employer respectively, form the basis of this co-operative education model. Work Integrated Learning refers to that component of co-operative education that can only be conducted by the employer. This learning provides the student with an opportunity to apply and develop the academic knowledge he / she received at the University to relevant problem situations in industry and exposure to typical organisational culture, human relations and working conditions.

The policy, procedures and guidelines set out in this document benefit the co-operative partnership (student, University and employer) in developing and introducing effective education / learning programmes and by being adaptable to technological developments within a relatively short period of time. With suitable guidance and supervision, the

student is taught the responsibility to work independently and to develop an awareness of the ethics and requirements of industry.

NB: A student will only be permitted to commence with and register for Laboratory Practice I and II provided the student has passed all the subjects in S1, S2, S3 and S4.

Professional Bodies

Membership to a professional body is not compulsory but is advisable.

3.7. Phased of Qualifications

NDip Biotechnology (phased out in 2016)
BTech Biotechnology (phased out in 2019)
MTech Biotechnology (phased out in 2019)

3.8. Enquiries

Enquiries may be addressed to:

HOD: Biotechnology	Tel	:	+27 16 950 9603
Faculty of Applied & Computer Sciences	Fax	:	+27 16 950 9794
Vaal University of Technology	E-Mail	:	
Private Bag X021	Website	:	www.vut.ac.za
VANDERBIJLPARK, 1900			
or			
Postgraduate Office	Tel	:	+27 16 950 9537
Ms B Phume	E-Mail	:	beatricet@vut.ac.za

3.9. Chemistry Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Prof SJ Modise	HoD	Phd
Xaba, T (Dr)	Senior Lecturer	DTech
Vacant	Administrator	
Pakade, V (Prof)	Associate Professor	PhD
Klink, M (Dr)	Senior Lecturer	PhD
Maboya, W (Dr)	Senior Lecturer	PhD
Pholosi, A (Dr)	Senior Lecturer	DTech
Shooto, ND (Dr)	Senior Lecturer	DTech
Viljoen, EL (Dr)	Senior Lecturer	PhD
Bucibo, M (Ms)	Lecturer	MTech
Dyantyi, SD (Mr)	Lecturer	MSc
Kemp, R (Ms)	Lecturer	MSc
Mabaso, N (Dr)	Lecturer	PhD
Moekwa, TB (Mr)	Lecturer	MSc
Molosioa, PS (Mr)	Lecturer	MSc
Mtshatsheni, KNG (Ms)	Lecturer	MSc
Sehloho, RS (Mr)	Lecturer	MSc
Matamela, T (Ms)	Technologist	MTech
Molete, P (Ms)	Technologist	MTech
Ngoy, P (Mr)	Technologist	MTech

3.10. Diploma: Analytical Chemistry

Four or five semesters of class attendance at the University, plus one or two semester Workplace Integrated Learning.

What are the Functions of a Chemistry Graduate?

Analysis of samples by the wet methods or using analytical instrument, writing reports on analysis and implementation of approved methods of analysis. Quality control in enterprises such as the following: petrochemical industries, fertilizer industries, mining industries, water purification plants, food processing factories, dairies, pharmaceutical factories, sewerage plants, etc. A chemistry researcher develops new analytical methods, theories and concepts as well as investigative and synthetic research.

Career Opportunities

A career in Chemistry offers challenging and exciting opportunities in both the private and public sectors. There is a continuous demand for trained Analytical Technicians with a diploma or a BTech qualification.

Entry level : Laboratory Assistant

Middle level : Laboratory Technician / Supervisor

Top level : Laboratory Manager

Research opportunities at both industry and research institutions as well as lecturing positions for those who holds a Master or Doctoral qualification.

Admissions Requirements:

National Senior Certificate (NSC) Entry Requirements:

Subjects	Diploma: Chemistry	Note
NSC Endorsement:	Eligibility for Diploma, or Bachelors' degree	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69%
Compulsory Subjects: Physical Science Mathematics English	 4 4 4	
Life Orientation	Max 3	
Any other 3 Subjects	9	
TOTAL	24	

Diploma Endorsement Required AND APS of 24 with a minimum of 50% (4) for English, Physical Science and Mathematics or 60% vocational Mathematics and Engineering Science.

Senior Certificate (SC) Entry Requirements:
Compulsory school subjects: Mathematics, Physical Science and English HG (E) or SG (D).
Points required: 26

National Certificate (Vocational) (NC (V)) Entry Requirements:
N/A

Curriculum

Semester 1	Semester 2
• Chemistry I • Physics I • Mathematics I • Applied Communication Skills (Module 1.1) • ICT Skills 1	• Analytical Chemistry I • Inorganic Chemistry II • Analytical Chemistry Practical I • Mathematics II • Organic Chemistry II
Semester 3	**Semester 4**
• Inorganic Chemistry III • Physical Chemistry II • Organic Chemistry III • Analytical Chemistry II • Analytical Chemistry Practical II	• Analytical Chemistry III • Analytical Chemistry Practical III • Chemical Quality Assurance • Physical Chemistry III
Semester 5	**Semester 6**
• Chemical Process Industries II • Entrepreneurial Skills • Industrial Chemical Analysis • Physics II theory • Applied Communication skills (Module 1.2 OR • Chemical Industry Practical P1	• Chemical Industry Practical P1 OR • Chemistry Project P2

Assessment
Assessment takes the form of tests, assignments, practicals, tutorials and final examinations.

Articulation Options

3.11.Advanced Diploma in Chemistry

Admission Requirements:

Diploma: Analytical Chemistry or equivalent relevant NQF level 6 360 credit qualification.
60% average on all third-year subjects not a requirement
Duration:
This a one year full-time or two years part-time course.
Curriculum:

Semester 1	Semester 2
• Analytical Chemistry IV • Physical Chemistry IV • Research Project IV *	• Inorganic Chemistry IV • Organic Chemistry IV • Research Project IV*

* Research Project IV runs for a full year.

3.12.Postgraduate Diploma

Admission Requirements

- Advanced Diploma: Chemistry or equivalent relevant

Semester 1	Semester 2
Research Project in Chemistry	Applied Physical Chemistry
Advanced Analytical Chemistry	Advanced Organic Chemistry
Applied Inorganic Chemistry	Research Project in Chemistry

3.13.Magister Technologiae /Master of Applied Science: Chemistry

Admission Requirements:

Minimum 60% entrance: BTech: Chemistry/ Postgraduate Diploma/ BSc Hons: Chemistry.
(Research Methodology subject / workshop must be completed within a year of registration).
Duration:
One Year Full-Time or Two Years Part-Time.
Curriculum:
Research project by dissertation.

3.14.Doctoris Technologiae /PhD: Chemistry

Admission Requirements:

- NQF level 9 related qualification with a minimum of 180 credits.

60% average not a requirement
Duration:
Minimum two years full-time or four years part-time.
Curriculum:
Research project by thesis.

Work Integrated Learning

Work Integrated Learning refers to that component of co-operative education that can only be conducted by the employer. This learning provides the student with an opportunity to apply and develop the academic knowledge he / she received at the University to relevant problem situations in industry and exposure to typical organisational culture, human relations and working conditions.

The curriculum is designed in such a way that the student may opt for a one year industrial exposure or six months industrial exposure. There are staff members appointed to co-ordinate the WIL by visiting students at the work place on a continuous basis.

Professional Bodies

Membership to a professional body is not compulsory but is advisable. However, students at BTech/Adv Diploma, MTech/Masters and DTech /PhD level are advised to affiliate with the South African Chemical Institute which is a body regulating all chemistry related matters in both Universities and Industries.

3.15.Phased out Qualifications

NDip Anlytical Chemistry (phased out in 2016)
BTech Analytical Chemistry (phased out in 2018)
MTech Analytical Chemistry (phased out in 2017)
DTech Analytical Chemistry (phased out in 2017)

3.16.Enquiries

Enquiries may be addressed to:

HoD: Chemistry	Tel	:	+27 16 950 9603
Faculty of Applied & Computer Sciences	Fax	:	+27 16 950 9794
Vaal University of Technology	E-Mail	:	
Private Bag X021	Website	:	www.vut.ac.za
VANDERBIJLPARK, 1900			

or

Postgraduate Office	Tel	:	+27 16 950 9537
Ms B Phume	E-Mail	:	beatricet@vut.ac.za

4. Department of Health Sciences

4.1. Departmental Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Dr CJ Grobler	HOD	DTech
Mokoena, NJ (Mr)	Administrator	BTech
Nursing		
Drake, JM (Ms)	Lecturer	MCur
Makhale, ME (Ms)	Lecturer	D Nursing
Mazibuko, MMM (Ms)	Junior Lecturer	B Cur
Modiko-Mokoena, IM (Ms)	Junior Lecturer	B Cur
Morobe, V (Ms)	Lecturer	MCur
Mothebe, MM (Ms)	Junior Lecturer	B Cur
Motloba, DL (Ms)	Junior Lecturer	BCur
Ramalisa-Budeli, R (Ms)	(nGAP) Lecturer	MCur
Rayise, S (Mr)	(nGAP) Lecturer	MSc
Sehume, OMM (Dr)	Senior Lecturer	PhD
Selepe, DH (Ms)	Lecturer	MPH
Biomedical Technology		
Amisi, KC (Ms)	Lab Technician	BTech
Chalwe, J (Mr)	Lecturer	MTech
Dlanjwa, V (Mr)	Lab Technician	BTech
Madonsela, ITE (Ms)	Junior Lecturer	BTech
Mkhumbeni, N (Ms)	Lecturer	MTech
Motale, C (Ms)	Lecturer	BTech Edu
Ngcakaza, IN (Ms)	Lecturer	MTech
Pule, PB (Mr)	Lab Technician	MTech
Roets, B (Mr)	Lecturer	MTech
Shivambu, BZ (Mr)	Lecturer	BSc Hons
Valentine, J (Ms)	Lecturer	MTech

4.2. Degree: Bachelor of Health Sciences in Medical Laboratory Sciences (BHSc: MLS)

The student will have the first five semesters of class attendance at the University followed by three semesters of clinical practice in a laboratory approved for training purposes by Health Professions Council of South Africa (HPCSA). In the last two semesters of clinical practice, the student will select an area of specialisation. Students must pass a final examination in their area of specialisation before they will graduate.

Seven semesters of class attendance at the University, plus one semester applicable in-service training in a laboratory approved for training purposes by the HPCSA.

What are the functions of a Medical Laboratory Scientist?

Qualified medical laboratory scientists are specialized health professionals who play an integral role in the healthcare of society by providing vital information about a patient's state of health. Their input is necessary in the diagnosis, monitoring and treatment of diseases. They diagnose chemical, blood, immunologic, tissue, cellular disorders and also the presence of microorganisms that cause diseases. They analyse human specimens such as blood, urine, sputum, stool, cerebrospinal fluid (CSF), peritoneal fluid, pericardial fluid, and synovial fluid, and more other specimens.

Career Opportunities

The analytical and diagnostic services provided by medical laboratory scientists require a strong scientific knowledge, as well as trained reasoning ability and empathy for humanity. Career opportunities exists in a variety of laboratory settings including national laboratories within hospital settings, private clinical laboratories, blood banking institutions, research, biotechnology, forensic, and reference laboratories.

Admissions Requirements

The student will have the first five semesters of class attendance at the University followed by three semesters of clinical practice in a laboratory approved for training purposes by Health Professions Council of South Africa (HPCSA). In the last two semesters of Clinical practice, the student will select an area of specialization. Students must pass a National Board Examination in their area of specialization before they graduate.

Subjects	**Bachelor of Health Science: Medical Laboratory Sciences**			
NSC endorsement	Eligibility for a Bachelor degree			
Compulsory subjects or equivalent (Standard or Higher grade system)	**NSC Minimum points**	**Higher grade**	**Standard grade**	**Rating codes**
English Mathematics Physical Science Life Science/Biology	4 4 4 5	D D D D	C C C C	3=40-49% 4=50-59% 5=60-69% 6=70-79% 7=80-89% 8=90-90%
Life Orientation	Max 3			
Any other 2 subjects	10			
	No Math Literacy			
Total	30			

Additional Entry Requirements: Applicants are required to have industrial knowledge (i.e. job shadowing) and may undergo placement testing

Qualification	**Compulsory subjects**	**Minimum Required Score**	**Additional Compulsory subjects**	**Score***	**Other subjects**	**Minimum APS required**	**Bonus points**
Bachelor of Health sciences: MLS	English Mathematics Physical Sciences Life Sciences	4 4 4 5	None	0	4 other subjects	**30**	Maths English Physical or Natural sciences

Curriculum

Year 1	
Semester 1	**Semester 2**
• Human Anatomy • Physiology & Disease I Module 1 • Introduction to Medical Laboratory Sciences I Module I • Health Chemistry I • Health Physics I • Biostatistics I	• Introduction to Medical Laboratory Sciences I Module II • Human Anatomy, Physiology& Disease I Module II • Cell Biology I • Immunology I • Laboratory Instrumentation and Techniques
Year 2	
Semester 3	**Semester 4**
• Clinical Chemistry II Module I	• Clinical Chemistry II Module II
• Microbiology II Module I	• Microbiology II Module II

• Haematology II Module I	• Haematology II Module II
• Immunohaematology II	• Cytology II
• Histology II	
Year 3	
Semester 5	**Semester 6**
• Clinical Chemistry III	• Integrative Medical Laboratory Sciences III. Module II (Clinical Practice)
• Microbiology III	• Research Methods III
• Haematology III	
• Cytology III	
• Integrative Medical Laboratory Sciences Theory III Module I	
Year 4	
Semester 7	
• Clinical Practise (students must choose one from the following specialisation)	
• Laboratory Management IV	
• Clinical Chemistry IV	
• Microbiology IV	
• Haematology IV	
• Immunohaematology IV	
• Cytology IV	
• Histology IV	
• Immunology IV	
• Virology IV	
• Forensic Sciences IV	
• Pharmacology IV	
• Cytogenetics IV	
• Clinical Pathology IV	

Work Integrated Learning

Training can be done in any of the following categories: Microbiology, Virology, Parasitology, Haematology, Immunology, Blood Transfusion Technology, Chemical Pathology, Pharmacology, Radio-Isotope Technology, Histopathology Techniques, Cytotechnology, Cytogenetics or Forensic Medical Pathology.

or

A minimum of six months practical training in each of the following categories: Microbiology, Chemical Pathology and Haematology. This combination is collectively known as Clinical Pathology.

Registration with Professional Board

On enrolment, it is mandatory that each student registers with the Health Professionals Council of South Africa (HPCSA) as a student Medical Laboratory Scientist as per regulations set out in the Government Gazette (Circular E2/a9/2, 79, 09,

28). Successful completion of this qualification will entitle the student to register with the Health Professions Council of South Africa (HPCSA) as a qualified Medical Laboratory Scientist.

4.3. Advanced Diploma in Biomedical Technology: AdvDip (Biomedical Technology)

NQF level: 7
Total Credits: 125 credits

Admission Requirements

Minimum of 60% or > 5 years HPCSA registered Medical Technologist

CURRICULUM

Semester 1	Semester 2
• Research methodology in biomedical Technology • Medical laboratory Management 1 • **Choose one elective subject from the list below:** • Advanced haematology 1 • Advanced chemical pathology 1	• Genetics 2 • Medical laboratory management 2 • Advanced haematology 2 • Advanced chemical pathology 2 • Advanced cytology 2 • Advanced histology 2
• Advanced cytology 1	• Advanced Medical Microbiology 2
• Advanced histology 1	• Advanced Virology 2
• Advanced Medical Microbiology 1	• Advanced cytogenetics 2
• Advanced Virology 1	• Advanced Immunology 2
• Advanced cytogenetics 1	• Immunohaematology 2
• Advanced Immunology 1	• Pharmacology 2
• Immunohaematology 1	• Forensic Technology 2
• Pharmacology 1	• Marketing in Health Sciences 2
• Forensic Technology 1	• Training in the Biomedical environment 2
• Marketing in Health Sciences 1	
• Training in the Biomedical environment 1	

Duration

This is a one year full-time or two years part-time course

4.4. POSTGRADUATE DIPLOMA: BIOMEDICAL TECHNOLOGY

NQF level: 8
Total Credits: 130 credits

Admission Requirements

Advanced Diploma in Biomedical Technology (60%average) or equivalent.

Duration: -
This is a one year full-time or two years part-time course

Curriculum

Semester 1	Semester 2
• Research Project in Medical Laboratory Science • Advanced Molecular Biology • Epidemiology and Biostatistics • Integrated Pathophysiology	• Management in Biomedical environment • Research Project in Medical Laboratory Science • Advanced Molecular Biology

4.5. Phased Out Qualifications

- Bachelor of Nursing (R425) last date of intake 31 December 2019
- B Tech Community Nursing last date of intake 31 December 2019
- National Diploma in Biomedical Technology remaining students were incorporated into the Diploma programme syllabus
- Diploma in Biomedical Technology last date of intake 31 December 2019
- B Tech Biomedical Technology last date of intake 31 December 2019
- All phased out programmes to be completed by 2021. No student will be allowed to continue with programme beyond 2021 as it will no longer be on the system.

4.6. Enquiries

Enquiries may be addressed to:

Administrator: Health Sciences	Tel	:	+27 16 950 7592
Faculty of Applied & Computer Sciences	Fax	:	+27 16 950 9794
Vaal University of Technology		:	+27 86 651 4274
Private Bag X021	E-mail	:	ntsanem@vut.ac.za
VANDERBIJLPARK, 1900	website	:	www.vut.ac.za

Administrator:	Mr N Mokoena
Tel:	(016) 950-7592
E-mail:	ntsanem@vut.ac.za
website:	www.vut.ac.za

5. Department of Information & Communication Technology

5.1. ICT Staff Details

No	Surname, Initials & Title	Section	Designation	Highest Qualification
1	Harmse, A (Dr.)	n/a	HoD	PhD
2	Zuva, T (Prof.)	ICT	Associate Professor	DTech
3	Van Eck, R (Dr.)	ICT	Senior Lecturer	DTech
4	Maneschijn, D (Ms.)	ICT	Senior Lecturer	MSc
5	Mokoena, N (Mr.)	ICT	Senior Lecturer	MSc
6	Sonhera, N (Ms.)	ICT	Senior Lecturer	MSc
7	Brown, AC (Mr.)	ICT	Lecturer	MTech
8	da Rocha, RD (Mr.)	ICT	Lecturer	MTech
9	du Toit, T (Mr.)	ICT	Lecturer	BTech
10	Hlatshwayo, MC (Ms.)	ICT	Lecturer	MTech
11	Matshego, I (Mr.)	ICT	Lecturer	MTech
12	Mngoma, R (Ms.)	ICT	Lecturer	BSc Hons
13	Moletsane, R (Mr.)	ICT	Lecturer	MSc
14	Moyo, S (Ms.)	ICT	Lecturer	MSc
15	Modupe, IA (Ms.)	ICT	Lecturer	MTech
16	Mposula, F (Ms.)	ICT	Lecturer	MTech
17	Piyose, X (Mr.)	ICT	Lecturer	MTech
18	Reid, R (Mr.)	ICT	Lecturer	BTech
19	Ribeiro, SV (Ms.)	ICT	Lecturer	BSc Hons
20	Sibanda, E (Mr.)	ICT	Lecturer	MTech
21	Thapeli, M (Ms.)	ICT	Lecturer	MTech
22	Leduma, N (Mr.)	ICT	Junior Lecturer	MTech
23	Nduwamungu, C (Mr.)	ICT	Junior Lecturer	BTech
24	Matsela, M (Mr.)	ICT	Junior Lecturer	BTech
25	Mkwanazi, SL (Ms.)	ICT Skills	Lecturer	BTech
26	Nhlapo, LC (Ms.)	ICT Skills	Lecturer	BTech

27	Senna, WM (Ms.)	ICT Skills	Lecturer	BTech
28	Thabane, LJ (Ms.)	ICT Skills	Lecturer	MTech
29	Venter, K (Ms.)	ICT Skills	Lecturer	BTech
30	Coka, PP (Ms.)	ICT Skills	Junior Lecturer	PGDHE
31	Lebyane, M (Ms.)	ICT Skills	Junior Lecturer	BTech
32	Manda, LA (Ms.)	ICT Skills	Junior Lecturer	BTech
33	Manele, DH (Ms.)	ICT Skills	Junior Lecturer	BTech
34	Mngqibisa, SG (Ms.)	ICT Skills	Junior Lecturer	BTech
35	Moloi, NI (Ms.)	ICT Skills	Junior Lecturer	BTech
36	Moreki, FB (Ms.)	ICT Skills	Junior Lecturer	BTech
37	Msimango, PI (Ms.)	ICT Skills	Junior Lecturer	BTech
38	Raphatelo, PM (Mr.)	Junior Lecturer	Junior Lecturer	NDip
39	Rikhotso, T (Ms.)	n/a	Administrator	BTech

5.2. Diploma: Information Technology (DI0600)

Three-year full-time course. The IT Diploma is offered in two specialised fields: Business Applications & Software Development.

Career Opportunities

Computerisation of most facets of modern society creates a multitude of possibilities. This includes the development of prototypes or systems and/or the supervised support of existing systems. The typical entry-level is that of a Programmer or Business Analyst.

Admissions Requirements:

National Senior Certificate (NSC) Entry Requirements:

<table>
<tr><th>Qualification</th><th colspan="5">Information Technology</th></tr>
<tr><td colspan="2">NSC Endorsement</td><td colspan="4">Diploma Endorsement Required</td></tr>
<tr><td>Compulsory Subjects</td><td>Score</td><td>Additional Compulsory Subjects</td><td>Other Subjects</td><td>Mainstream APS</td><td>Bonus Points</td></tr>
<tr><td>English</td><td>4</td><td rowspan="4">None</td><td rowspan="4">Four other subjects totalling 16</td><td rowspan="3">24 or above</td><td rowspan="4">Mathematics
English or Natural Sciences</td></tr>
<tr><td>Mathematics or</td><td>4</td></tr>
<tr><td>Technical Mathematics or</td><td>4</td></tr>
<tr><td>Mathematical Literacy</td><td>6</td><td>26 or above</td></tr>
</table>

A maximum of 6 subjects are taken into consideration when calculating the total APS score, excluding Life Orientation

Curriculum

Two Information Technology specialisation fields are offered: Business Applications & Development Software.

Development Software		
Year 1	**Year 2**	**Year 3**
• Information Systems I • Systems Software I • Development Software I • Programming Logic I • Accounting Skills I • Applied Communication I	• Information Systems II • Development Software II • Business Analysis II • Systems Software II • Applied Communication II • IT Law • Entrepreneurship	• Development Software III • Business Analysis III • Web Development III
Business Applications		
Year 1	**Year 2**	**Year 3**
• Information Systems I • Systems Software I • Development Software I • Programming Logic I • Accounting Skills I • Applied Communication	• Information Systems II • Development Software II • Business Analysis II • Systems Software II • Web Management II • Applied Communication II • IT Law • Entrepreneurship	• Information Systems III • Business Analysis III • Web Development III

Articulation Options

5.3. Advanced Diploma: Information Technology (AD0600))

The Advanced Diploma: IT is offered only at the Vanderbijlpark campus. It is offered on a full-time basis; therefore, students are required to take a full load of subjects. The minimum duration is one year. Eight modules must be completed and ONLY seven modules can be completed if Networks is taken an elective module. One elective subject is chosen per semester. In the case of Networks, if chosen, this will be the chosen elective for both semesters 1 and 2.

NB: It is imperative that students wishing to apply for Advanced Diploma: Information Technology, have an average of 60% for their final year subjects in their previous qualification.

Admission Requirements:

Diploma: Information Technology or equivalent relevant NQF level 6, 360 credit qualification.
60% Average on all third-year subjects (Ad hoc cases will be treated on merit).

Curriculum:

Semester 1	Semester2
• Emerging Technologies (Compulsory) • Statistics for IT (Compulsory) • IT Management (Compulsory) • Advanced Software Design (Elective) • Computer Security (Elective)	• Research Methodology for IS and Technology (Compulsory) • Advanced Databases (Compulsory) • User Experience Design (UXD) (Compulsory) • IT Auditing (Elective) • Artificial Intelligence (Elective)
• Networks (Elective)	• Networks (Elective)

Credits

- 120 credits on NQF level 7

5.4. Postgraduate Diploma: Information Technology (PG0600)

The Postgraduate: IT is offered only at the Vanderbijlpark campus. It is offered on a full-time basis, therefore only during the day. The minimum duration is one year. Six modules must be completed.

Admission Requirements:

- Advanced Diploma: Information Technology or equivalent relevant NQF level 7, 120 credit qualification (Ad hoc cases will be treated on merit).

Curriculum:

Semester 1	Semester2
• Advanced supportive techniques and technologies • Business Intelligence • Software Engineering	• Strategic Business Analysis • Database Administration • Research Project in Information Systems and Technology

Credits

- 120 credits on NQF level 8

5.5. Magister of Information and Communication Technology (MICT)

Admission requirements:

- NQF level 8 related qualification with a minimum of 120 credits or equivalent, with Research Methodology as a prerequisite with a 60% average for all subjects
  (Ad hoc cases will be treated on merit)

Duration:

- Minimum 2 years, maximum 3 years part time study.

Curriculum

- Research project by dissertation

Credits

- 180 credits on NQF level 9

5.6. Doctor Philosophiae in Information and Communication Technology (DD0600)

Admission requirements:

- NQF level 9 related qualification with a minimum of 180 credits or equivalent with, a 60% average
  (Ad hoc cases will be treated on merit)

Duration of course:

- Minimum 2 years, maximum 4 years part time study.

Curriculum:

- Research project and thesis

Credits

- 360 credits on NQF level 10

5.7. Work Integrated Learning

The IT Diploma does not have a formal Work Integrated Learning component.

The following subjects are offered as service subjects:

Qualification	Subjects
i) Diploma: FIS	• Financial Information Systems 1 • Financial Information Systems 2.1 and 2.2 • Financial Information Systems 3.1 and 3.2

ii)	Diploma: Electrical Engineering	• Engineering Programming 2 • Computing Applications 2 • Programming 2 • Engineering Programming 1 • Engineering Programming II • Engineering Programming III • Computer Applications • Artificial Intelligence • New Technology Programming
iii)	Diploma: Industrial and Operations Management	• Programming I • Programming II
iv)		• ICT Skills 1
v)	Diploma: Safety Management	• Computing for Safety Management
vi)	Diploma: Tourism Management	• Advanced ICT Skills for Tourism
vii)	Diploma: Legal Assistance	• Computing for Legal Assistance
viii)	Diploma: Food Service Management	• ICT Skills for Hospitality 2.1
ix)	Diploma: Public Relations	• Advanced ICT Skills for Public Relations

5.8. Phased out Qualifications

Programme Name	**Programme Code**	**Last Registration Date (for new students)**	**Last Re-enrolment Date for Completion**	**Last Graduation Date**
National Diploma: IT (ND: IT)	206010	31 December 2016	2021	Autumn Graduation (Early 2022)
Bachelor of Technology: IT (BTech: IT)	306017	31 December 2019	2022	Autumn Graduation (Early 2023)
Master of Technology: IT (MTech: IT)	606002	31 December 2019	2022	Autumn Graduation (Early 2023)
Doctor of Technology: IT (DTech: IT)	706000	31 December 2019	2022	Autumn Graduation (Early 2023)

5.9. Enquiries

Enquiries may be addressed to:

HoD: ICT	Tel	:	+27 16 950 9605
Faculty of Applied & Computer Sciences	Fax	:	+27 16 950 9497
Vaal University of Technology	E-Mail	:	tiyiselamir@vut.ac.za
Private Bag X021	Website	:	www.vut.ac.za
VANDERBIJLPARK, 1900			

or

Postgraduate Office	Tel	:	+27 16 950 9537
Ms B Phume	E-Mail	:	beatricet@vut.ac.za

6. Department of Mathematics, Non- Destructive Testing & Physics

6.1. Mathematics Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Sikakana, QI (Dr)	HoD	PhD
Ntseane, GE (Ms)	Administrator	BTech & PGDHE
Mahlobo, RK (Dr)	Senior Lecturer	PhD
Mbongwe, MJ (Mr)	Senior Lecturer	MSc
Mofokeng, J (Mr)	Lecturer	MSc
Mthombeni, TT (Mr)	Lecturer	MSc
Mukamuri, M (Mr)	Lecturer	MSc
Owusu-Mensah, J (Dr)	Senior Lecturer	PhD
Sibanda, B (Dr)	Senior Lecturer	PhD
Mlungisi, MAD (Mr)	Lecturer	MSc
Zimba, K (Dr)	Senior Lecturer	PhD

The mathematical subjects offered to students registered in career-oriented programmes in Applied Sciences, Engineering & Technology are:

- Biostatistics
- Calculations & Statistics
- Mathematics I
- Mathematics II
- Mathematics III
- Mathematics IV
- Mathematics V

6.2. NDT & Physics Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Sikakana, QI (Dr)	HoD	PhD
Ntseane, GE (Ms)	Administrator	BTech & PGDHE
NDT		
Mabuza, BR (Prof)	Executive Dean	PhD
Nolting, V (Dr)	Senior Lecturer	PhD
Molefe, L (Ms)	Junior Lecturer	BTech NDT Levels: UT I
Ngobeni, MC (Mr)	Junior Lecturer	BTech NDT Levels: UT (WT), MT II, PT II
Nkwanyana, ZSS (Ms)	Junior Lecturer	AD: NDT NDT Levels: RT II, Welding Inspection
Nyambeni, N (Mrs)	Junior Lecturer	AD: NDT NDT Levels: UT II, MT II, PT II, ECT I
Shavhani, K (Ms)	Junior Lecturer	BTech NDT Levels: UT II, ECT I
Physics		
Mbandezi, ML (Mr)	Lecturer	MSc
Melato, LT (Mr)	Lecturer	MSc
Nemalili, FP (Mr)	Lecturer	MSc
Thebe, MJ (Mr)	Technologist	MSc
Mmethi, FM (Mr)	Lecturer (secondee)	MSc
Malinga, L (Ms)	Technician	BSc (Hons)
Mbuli, NL (Dr)	Contract-Lecturer	PhD
Rantho, MN (Dr)	Contract-Lecturer	PhD
Sithole, P (Ms)	Contract-Lecturer	MSc
Sithole, TM (Mr)	Contract-Lecturer	MSc
Modisakeng, KH (Ms)	Contract-Technician	BSc (Hons)
Malatsi, T (Ms)	Contract-Technician	BSc (Hons)

The physics subjects offered to students registered in programmes in Applied Sciences, Engineering & Technology are:

- Physics I
- Physics II
- Biophysics
- Health Physics

6.3. Diploma: Non-Destructive Testing

Three years full-time.

Purpose of the Diploma in Non-Destructive Testing

The art of material inspection complemented by the knowledge of the 'inspection system'

The Diploma integrates the basic sciences – mathematics, chemistry and physics - with the applied sciences of metallurgy, fracture mechanics and the notion of quality assurance so that this knowledge can be used to make an informed decision on the state of a component and its continued use (or its intended purpose).

The different methods used in the inspection require in-depth theoretical understanding for them to be optimally applied, taking into consideration the various conditions under which the component operates.

Analysis of the results obtained from these methods requires knowledge and continuous operational experience. In the process of analysis, challenges are encountered in interpretation, and hence the capability to engage in research and development.

The Diploma is designed to be also applicable in inspection according to the different codes and standards of Non-Destructive Testing. It is a progressive qualification and empowers the Diploma graduate to seek innovation in the application of the NDT methods that is grounded in sound scientific knowledge creation. For example, understanding material characteristics of different metal components in machine design and the identification of locations of concentrated stress, hence likelihood of the initiation of fracture. These graduates are thus well suited to be part of a team in the design stage of plant machinery.

The Diploma in Non-Destructive Testing empowers the student with a broad spectrum of knowledge, that is, theoretical concepts and information, which will be encountered during inspection in varied industries. This knowledge is acquired through blended learning, practical laboratory experience and industrial work-based experiential training / work integrated learning (WIL).

The knowledge (expertise) is expected to increase exponentially with experience, taking note that the world is already transforming into a 'knowledge economy'. This diploma is therefore already addressing key requirements of an 'inspection system' for the present applications and moving into the future.

The above is supported by a sample of past graduates in their employment trends in various industrial sectors.

Aspiring students should take heed of the following:

- Requirement for NDT Level Certification according to **ISO 9712:2012 Non-destructive testing -- Qualification and certification of NDT personnel** document.
- Requirement for NDT Level Certification according to **Recommended Practice No. SNT-TC-1A - Personnel Qualification and Certification in NDT**
    - The Diploma in Non-Destructive Testing qualification does not replace the NDT industry requirement for NDT Level Certification, that is, Level 1, 2 or 3 for each of the NDT methods as applicable in the industry. Students are thus required to obtain the NDT level Certification to operate within the industry. The VUT is incorporating the NDT Level Certification training on campus for the basic methods for students who complete S5.
    - Service providers are in the interim providing the NDT Level Certification during university vacation periods – through Memoranda of Understanding [MOU] - to both past [completed S4 – National Diploma] and the present [completed S5] students.

These International Standards incorporate:

- The initiation, promotion, maintenance and administration of the certification scheme according to ISO/IEC 17024;
- Publishing specifications for training courses that include the syllabi, which embodies the content of recognized documents, for example, ISO/TR 25107 and ANSI/ASNT CP-105 – *Topical Outlines for Qualification of Non-destructive Testing Personnel.*
- The general examinations are to address the basic principles of the applicable method.
- The specific examinations are to address the equipment, operating procedures, and NDT techniques that the candidate may encounter during specific assignments to the degree required. This will include specifications or codes and acceptance criteria.
- The candidate must demonstrate familiarity with and ability to operate the necessary NDT equipment, record, and analyse the resultant information to the degree required.
- The description of the specimen, the NDT procedure, including checkpoints, and the results of the examination must be documented.
- Sectors for examination
    - Product sectors
        - Castings
        - Forgings
        - Welds
        - Tubes and pipes
        - Wrought products
        - Composite materials
    - Industrial sectors
      Test specimens are varied with the below industrial sectors taken into consideration. This results in combinations of two or more product sectors.
        - Manufacturing
        - Pre- and in-service testing (includes manufacturing)
        - Aerospace
        - Railway maintenance
    - Multi sectors
      Comprises all above mentioned industrial sectors
- List of NDT Documents
    - **ISO 9712:2012 Non-destructive testing -- Qualification and certification of NDT personnel** document.

- **Recommended Practice No. SNT-TC-1A 2006 - Personnel Qualification and Certification in NDT**
- ASNT standard ANSI/ASNT-CP-189
- ANSI/ASNT CP-105 – Topical Outlines for Qualification of Non-destructive Testing Personnel
- ISO/TR 25107:2006 Non-destructive testing - Guidelines for NDT training syllabuses.
- ISO/TR 25108:2006 Non-destructive testing – Guidelines for NDT personnel training organizations.
- ISO/IEC 17024:2012 Conformity assessment. General requirements for bodies operating certification of persons.
- ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories.

- Students enrolling in the Diploma in Non-Destructive Testing will therefore have to pass these NDT Level Certification examinations for them to be considered for industrial experience / WIL.

- ***NB: All registered students will be subjected to Level Certification, which is the prerequisite to operate in the NDT industry and required by applicable codes & standards.***

  This requirement is comparable to the board examination required for Biomedical Technology graduates to work in the National Health Laboratory Services (NHLS).

- According to the South African National Accreditation System (SANAS), the VUT as an education and training institution is not required to have its laboratories subjected to accreditation [ISO/IEC 17024 & ISO/IEC 17025] – Generic Brochure - ACCREDITATION OF CONFORMITY ASSESSMENT BODIES ENABLES CONFIDENCE AND TRUST
  The objectives of SANAS are to:
- accredit or monitor for Good Laboratory Practice compliance purposes, organisations falling within its scope of activity;
- promote accreditation as a means of facilitating international trade and enhancing the Republic's economic performance and transformation.
- promote the competence and equivalence of accredited bodies; and
- promote the competence and equivalence of Good Laboratory Practice compliant policies.

Career Opportunities

NDT Technician: Perform inspections, monitoring, evaluations using non-destructive methods and quality assessment techniques. This is achieved through both fabrication and maintenance inspections conducted in accordance with regulatory requirements (codes and specifications). The technician can be part of an NDT department or unit within a company or as an independent service provider.

NDT Specialist / Technologist: Being part of a team involved in project development including design, fabrication and specifying inspection techniques and methods to be used to ensure product safety, reliability, and longevity.

NDT Research and Development Professional: Working on improving the reliability of inspection methods and techniques. Further developing new techniques to inspect the improved materials and products utilised in the industry.

Admissions Requirements:

National Senior Certificate (NSC) Entry Requirements:

Subjects	Diploma: Non-Destructive Testing	Note
NSC Endorsement:	Eligibility for Diploma, or Bachelors' degree	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69%
Compulsory Subjects: Physical Science Mathematics English	 4 4 4	
Life Orientation	Max 3	
Any other 3 Subjects	9	
TOTAL	24	

Senior Certificate (SC) Entry Requirements:
Compulsory school subjects: Mathematics, Physical Science and English HG (E) or SG (D).
Points required: 26

National Certificate (Vocational) (NC (V)) Entry Requirements:
N/A

Curriculum

Semester 1	Semester 2
• Chemistry I (15) • Mathematics I (12) • Physics I (12) • Applied Communications Skills I-Module 1 (8) • ICT Skills (10) • Intro to NDT (Theory) (6) • Intro to NDT (Practical) (6)	• Drawing: Mechanical Engineering (12) • Liquid Penetrant Testing Theory (8) • Liquid Penetrant Testing Practical (8) • Radiographic Testing Theory (8) • Radiographic Testing Practical (8) • Mathematics II (12) • Applied Communication Skills I-Module 2 (8) • Physics II Theory (8) • Physics II Practical (4)
Semester 3	**Semester 4**
• Magnetic Particle Testing Theory (8) • Magnetic Particle Testing Practical (8) • Ultrasonic Testing Theory (8) • Ultrasonic Testing Practical (8) • Metallurgy for NDT 1 (12) • Introduction to Fracture Mechanics (12)	• Eddy Current Testing Theory (8) • Eddy Current Testing Practical (8) • Advanced Ultrasonic Testing Theory (8) • Advanced Ultrasonic Testing Practical (8) • Quality Assurance II (12) • Metallurgy for NDT 2 (12) • Entrepreneurship 1 (10)
Semester 5	**Semester 6**
• Advanced Eddy Current Testing Theory (8) • Advanced Eddy Current Testing Practical (8) • Advanced Radiographic Testing Theory (8) • Advanced Radiographic Testing Practical (8) • Signal Processing (8) • Project (12)	• Work Integrated Learning 1 (60)

NB: Module credits are in brackets

Assessment

Assessment is continuous or summative according to the module-learning guide and is aligned with the university's assessment policy.

Work Integrated Learning

Six Months for work-based experiential training.

Articulation Options

6.4. Advanced Diploma: Non-Destructive Testing

Admission Requirements:

- The VUT National Diploma / Diploma in NDT (360 credits at NQF Level 6).
- National Diploma or Diploma in Metallurgical Engineering, Mechanical Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering and Industrial Engineering with an average of 55% from all S4 subjects for National Diploma or an average of 55% from all S5 subjects for Diploma.
- Bachelor's Degree in Physics, Mathematics and Chemistry with an average of 55% from all final year subjects including Mathematics II and Physics II in case where they are not major subjects.

All applicants received by the published closing date will be evaluated and selected according to the average achieved for all final semester / year subjects. Only the top ranked applicants will be offered admission as per the applicable Enrolment Plan.

Duration:

This is a one-year full-time course.

- Curriculum:

Semester 1	Semester 2
• Ultrasonic Testing Techniques • Fracture Mechanics • Numerical Analysis with Matlab Applications • Research Methodology	• Radiographic Testing Techniques • Electromagnetic Testing Techniques • Corrosion Inspection and Monitoring Techniques • Thermographic Testing Techniques • NDT Project IV
Electives	
• Optical Testing Methods • Penetrant Testing Methods • Acoustic Emission Testing Methods	

These qualifications develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent NDT technologist. It empowers graduates with a much more in-depth theoretical knowledge to competently perform NDT inspection with insight and the capabilities matching those of their peer engineering professions. The acquired knowledge, understanding, research skills, and ethics in the workplace, is an advantage in career progression.

Professional Bodies

South African Institute of Non-Destructive Testing (SAINT).

British Institute for Non-Destructive Testing (BINDT).

American Society for Non-Destructive Testing (ASNT).

6.5. Phase out Qualifications

- National Diploma in Non-Destructive Testing [course code: 215048, which had the last date of intake being 31 December 2016].
- National Diploma in Non-Destructive Testing (Extended) [course code: 215099, which had the last date of intake being 31 December 2014].

- No student will be allowed to continue with phased out programmes beyond 2021 as they will no longer be active on the system [6-year maximum duration for the completion of the qualification elapsed].

6.6. Enquiries

Enquiries may be addressed to:

HoD: NDT & Physics	Tel	:	+27 16 950 9321
Faculty of Applied & Computer Sciences	Fax	:	+27 16 950 9794
Vaal University of Technology	E-Mail	:	ike@vut.ac.za
Private Bag X021	Website	:	www.vut.ac.za

7. Syllabi

Accounting Skills I

Basic accounting skills - Interpretation and application of accounting principles.

Advanced Eddy Current Testing - Theory

Significant discoveries about electromagnetism; Modern Eddy Current Testing; Material variables detectable by Eddy Currents; Major application areas; Power dissipation of eddy currents; Diffusion equation; Maxwell's equations; Material properties; Electromagnetic acoustic transducer; The undamped uniform plane wave; Wavelength and phase velocity; Wave impedance; Uniform damped plane waves; The skin effect; Reflection of plane waves at normal incidence; Some comments on uniform plane waves; Pointing's theorem; Interference sources; Passive circuit elements; Digital signals; Pre-amplifiers in the TOFD technique; The electromagnetic interference of ultrasonic pulse-preamplifier; The shielding effectiveness theory; Filters; Metal impedance, skin depth, barrier impedance; The skin depth; New shielding materials; Seams and joints, and ventilation; General properties; The Hertzian dipole; The small loop antenna; Antenna properties; Radar; Basic operation of a radar system; Unambiguous range; Range and Angular resolutions; Target detection; Microwave NDT; Development of time domain reflectometry eddy current tests; Intelligent materials with microwave trouble signals; Basic Principle; Magnetism; Electromagnetism; Permeability; Features; The impedance; Eddy current concept; Impedance diagrams; Test coil impedance; Field distributions; Eddy current testing probes; Eddy current applications; Multiple frequency techniques; Pulsed eddy current inspection; Remote field testing; Remote field principle and skin depth theory; Display of signal and quantification of depth; Theoretical model of mathematical compensation; Reference standards; Eddy current display media; Effect of phase lag on the conductance curve; Lift-off curves and fill factor; Edge effect; Surface coil impedance curves for material and performance variables; Conductivity variation; Ferromagnetic materials; Discontinuity signal display; Subsurface discontinuities; Surface-breaking discontinuities; Shape of the Eddy current field; Display of discontinuity orientation; Enhancing signal display; Thickness variation; Plating and cladding; Spacing between conducting materials; Differential surface coil display; Encircling and internal coil display; Law of similarity; Test procedure; Testing non-ferromagnetic tubes; Testing ferromagnetic tubes; Characterisation of microstructures; Applications of Eddy Current Testing; Advantages of Eddy Current Testing; Disadvantages of Eddy Current Testing; Designing and building an Eddy Current position sensor; Physics and behavior; Target selection; Sensor design; Circuit design; A model sensor system design; What to remember about ECT; Reference standards; and Glossary of key terms.

Advanced Eddy Current Testing - Practical

Historical and developmental process; Basic physics and controlling principles; Generation of eddy currents in conductors; Eddy current propagation and decay, standard depth of penetration; Near field, transition, and remote field eddy currents; Properties of remote field eddy currents; Probes; Factors affecting choice of probe type; Frequency; Coil drive: current/voltage; Pre-amp gain ; Display gain; Standardization; Display types; RFT reference curve; Chart recordings; Odometers; Storing and recalling data on computers; RFT theory Types of RFT sensing probes; Test part; Test system; Definition; Relationship to RFT testing ; Methods of improving signal-to-noise ratio: Relationship of frequency to depth of penetration ;Relationship of frequency to resolution; Dual frequency operation; Beat frequencies; Optimum frequency; Fill factor; Importance of centralizing the probe; Probe drive and penetration; Effect of increasing thickness, conductivity or permeability; Position of receive coils versus field strength; Amplification; Phase and amplitude detection (lock-in amplifier); Differentiation and filtering; Instruments; Reference standards; Factors affecting signals; Selection of test frequencies; Tubulars of test frequencies; Tubulars using internal probes; Tubulars using external probes; Other applications; Accept/reject criteria; Signal classification processes; Detection of signals of interest; Signal recognition, data analysis, flaw-sizing techniques; Three zones in RFT; Through – transmission nature of RFT; Standard depth of penetration factors; Signal analysis; Display options; Advanced applications; Writing procedures; ASTM E 2096; SNT-TC-1A; Supervision and training; Administering exams; Ethics ; Reports: essential elements and; Legal responsibility.

Advanced Information & Technology Management IV

Management principles – General, personnel, financial and installation management.

Advanced Materials Evaluation - Theory

Separated transducers; Basic principles; Mathematical model for TOFD; Diffraction of waves; TOFD in anisotropic materials; TOFD in isotropic materials; Mathematical model; Application of TOFD; Advantages of TOFD technique; Disadvantages of TOFD technique; Process factors influencing the susceptibility to defects of different types; Operation of phased arrays; Implementation of phased arrays; Scan types; Combined scans; Basic theory of ultrasonic phased array; Applications of phased arrays; Linear phased arrays; Focusing formula; Distribution of pressure for beam focusing; Time delay; Methodologies of thermal Non-destructive testing; Physical principles; Thermal property requirements; Thermographic signal reconstruction; Thermal wave theory; Defect detection; Advanced signal processing techniques; Advantages of thermographic testing; Disadvantages of thermographic testing; Heat source finite pulse time effects; Lasers; Basic parts of a laser; Characteristics of laser light; Principle of laser; Advantages of laser ultrasound; Laser ultrasound; Principle of laser based detection of ultrasound; Interferometry; Type of lasers used for generation;

Applications of laser laser ultrasound; Application for laser ultrasound; Laser ultrasonics for materials characterization; Corrosion; Mechanism of corrosion; Types of corrosion; Corrosion of steel in concrete; Corrosion detectability; Detection of corrosion; and Probability of detection.

Advanced Materials Evaluation - Practical

Practical sections; Laboratory periods; Casting; Forging and rolling; Extrusion; Welding; Material; **PHASED ARRAY –** Purpose; Scope of application; Organization and personnel requirements; Class notation; Terminology of PA; History of PA; Review of ultrasonic wave theory: longitudinal and shear wave; Basic principle of phased array; Introduction to PA concepts and theory; Scan plans and exam coverages; Data presentations; Computer-based systems; Focal law generation; Probes; Wedges; Scanners; Blocks; Parameter settings; Calibration; Design of testing procedures; Collection of data; Encoded scans; Zone discrimination; On-site data acquisition; Specific applications; Data interpretation and evaluation; Reporting; Storage of documents; **TOFD -** Introduction to TOFD; Review of ultrasonic wave theory; Basic principle of Time of flight diffraction; TOFD concepts and theory; Technique limitations; Types of scan; Data presentations; Effects of curvature; Computer-based systems/ Software; Beam profile tools; Probes; Wedges; Blocks; Parameter settings; Calibration; Data collection; Encoded scans; On-site data acquisition; Specific applications; Data interpretation and evaluation; Codes/ standards/ specifications; Reporting; Storage of documents; The nature of heat and flow; Temperature measurement principles; Heat transfer modes and basic calculations; Proper selection of thermal/ infrared testing (TIR) as technique of choice; Introduction to Thermography; Operation of support equipment for infrared surveys; Radiosity concepts familiarization and problems/ Basic theory and building applications; Resolution tests and calculations; Error potential in radiant measurements (an overview); The infrared spectrum; Operating for infrared measurements (quantification); Operating for high-speed data collection; Operating special equipment for active techniques; Infrared image and documentation quality; Recording; Detecting thermal anomalies resulting from differences in thermal resistance (Quasi-steady state heat flow); Detecting thermal anomalies resulting from differences in thermal capacitance, using system or environmental heat cycles; Detecting thermal anomalies resulting from differences in physical state; Detecting thermal anomalies resulting from fluid flow problems; Detecting thermal anomalies resulting from friction; Detecting thermal anomalies resulting from non-homogeneous exothermic or endothermic conditions; Field quantification of point temperatures; Temperature measurement applications; Energy loss analysis applications; Active applications; Filtered applications; Transient applications; Building applications; Composite material applications; Equipment/ Materials; Heat flux indicators; Performance parameters of non-contact devices; Exothermic or endothermic investigations; Friction investigations; Fluid flow investigations; Thermal resistance (steady state heat flow) investigations; Thermal capacitance investigations; Contact temperature indicators; Non-contact pyrometers; Thermal/ infrared imaging; Heat flux indicators; Checking equipment calibration with blackbody references; Codes, standards and Procedures; Support data collection; Surface reference temperatures; Identification and other; Interpretation/ Evaluation; Reports and documentation; Safety responsibility and authority; Safety for personnel; Safety for client and facilities; Safety for testing equipment; and corrosion experiments.

Advanced Radiographic Testing - Theory

Objective of radiation protection and safety; Regulatory authority; Appointment of radiation protection officers; Workplace monitoring; Testing and maintenance of equipment; Operational instructions; Industrial radiographer/worker; Instructions for use and maintenance; Instructions for use and maintenance; Additional precautions for gamma radiography; What is Radiation?; Units for Measuring Radiation; Biological Effects of Radiation; Biological Damage Factors; Radiation safety on Real time radiography; Sources in industrial radiography; History of Digital Radiography; Conventional radiography; Digital radiography; Spatial resolution in Digital radiography; Pixel depth; Flat panel detectors; Exposure time and energy; Results without chemical processing; High quality of images; Enhanced Archiving and Retrieval; The working principle of computed radiography; What to consider when deciding to use Computed Radiography; Digital images; The application of CR; Advantages of CR; The limitations of CR; Special radiographic techniques; High resolution X-ray microscopy; Microfocus and nanofocus X-ray tubes; Image intensifier tube systems; Image quality; Image sharpness; Image contrast; Image noise; Image quality requirement in RTR system; Image processing; Image data analysis; Real time X-ray imaging system for boiler tubes; Tube handling system; Image processing software; Hardware; Advantages of Real Time Radiography; Applications; Codes and Standards; Inspection speed; Image resolution; Image Magnification; Image enhancement; Real time Radiography system costs; Computing capacity and scanning time; Reverse engineering; CT metrology; High resolution and defect sizing; CT for defect detection and sizing; Beer Law of attenuation; The system of tomographic testing; Principle of industrial computed tomography; Fundamental properties of matter; Radioactive materials; Types of radiation; Interaction of radiation with matter; Exposure devices and radiation sources; Imagine viewing; Application techniques; Image interpretation and processing; Hardware configuration; Image fidelity indicators; Advanced image processing and algorithm analysis; Detectors election; Principle of tomographic testing in NDT; Resolution; Advantages of tomographic testing; Disadvantages (drawbacks) of tomographic testing; Recommendations on drawbacks; Image reconstruction; Transmitted intensity; A numerical study on the effect of object functions on tomography reconstruction; Radon transform; Safety radiation project review; Principles of neutron radiography; Image and non-image devices; Miscellaneous applications; Techniques – calibrations; Interpretation – evaluation; Procedures; Neutron Beam; Neutron Sources (reactors, accelerators, isotopic sources) ; Neutron collimators; Neutron radiographic techniques; Applications of neutron radiography; Collimation; Quality control of Neutron radiography; Advantages of proton radiography; Principle of proton radiography; Application of protons to radiography; Simulation using CAD model; Monte Carlo methods and their application in X-ray image simulation; Generative image for flaw simulation in product radiographs; Image generation technology; Defect image collecting; Visual feature analysis and nonparametric sampling; Counter based hierarchical template model; Visual feature analysis and fuzzy representation.

Advanced Radiographic Testing - Practical

Casting; Weldments; History of industrial neutron radiography; General principle of examination of materials by penetrating radiation; Relationship of penetrating neutron radiation, radiography and radiometry; Comparison with other NDT methods, particular with X-rays and Gamma rays; General area of applications; Specific areas of application in industry; Review on nature of penetrating radiation; Radiation source for Neutrons (Specific description); Beam design Radiometry; Radiation- detection imaging; Film-principles, properties and uses with neutron converter screens; Blocking and filtering; Multi film technique; Enlargement and projection; Stereo-radiography; Triangulation methods; Autoradiography; Flash radiography; In motion radiography; Fluoroscopy; Electron emission radiography; Micro radiograph; Tomography; Control of diffraction effect; Panoramic exposures; Gaging; Real time imaging; Image analysis techniques; Direct TV viewing; Non-imaging devices; Gaseous and ionization detectors; Neutron detectors; Gaging and control processes; Basic neutron imaging considerations; Film processing and viewing of radiographs; Viewing of radiographs; Causes and correction of unsatisfactory radiographs; Arithmetic of exposure and other factors affecting neutron radiographs; The radiographic process; Imaging considerations; Test results and interpretation; Codes, standards, specification, and procedures; Introduction to computed radiograph; Computed radiography (CR) system capabilities; System component; Basic CR Techniques; Digital image Processing; Application techniques; Image display characteristics and viewing; CT technical requirements; CR technical developments; Evaluation of CR images; Image viewing; Standards, codes, and procedures for radiography; Computed Tomography Techniques - CT technical background; Physical basis- X ray interactions with material properties; Mathematical basis- line integral; Data sampling principle; Physical limitations of the sampling process; CT System performance- characterizing system performance; CT system performance measurements and monitoring; Image interpretation and processing; Advanced image processing algorithms; Radiographic evaluation and interpretation in tomography; Digital radiography overview; Image file format and compression (JPEG, TIFF, DICONDE); Advantages and disadvantages; Lossy versus lossless; Sampling theory; DR system over view; DR system capabilities; DR system components; Image fidelity; Detector issues for the detectors used/ Additional detector selection criteria/ parameters; Detector calibration for the detectors used; Detector selection; Detector monitoring; Detector maintenance; Image processing (post processing); Arithmetic; Acquisition system considerations; DR image quality topics/ technique development considerations; Image viewing; Application techniques; Triangulation methods for discontinuity location; Qualification of DR procedures; Use of Digital Reference Images; Valuation; Personnel safety radiation protection review; Methods of controlling radiation exposure; Specific equipment requirements; and Operation and emergency procedure.

Analytical Chemistry I

The nature of analytical chemistry; Laboratory practice and safety; Calculations used in analytical chemistry; Elementrary statistics including significant figures, precision and accuracy; Statistical data treatment and evaluation; Sampling and sample handling and Introduction to classical analysis.

Analytical Chemistry II

Calculations used in analytical chemistry; Aqueous solutions and chemical equilibria; Gravimetric methods of analysis; Precipitation titration; Principles of neutralisation titration; Titration curves for complex acid / base system; Application of neutralisation titratious; Electrochemistry; Analytical separation and Refractometry and polarimentry.

Analytical Chemistry III – Module 1

Data handling; Absorption and emission spectrometry; Ultraviolet and visible spectrometry; Infrared spectroscopy and X-ray spectroscopy.

Analytical Chemistry III – Module 2

General principles of chromatographic methods; Potentiometry; Electrogravimetry and coulometry; Polaragraphy; Themogravimetry and Thermal methods of analysis.

Anatomy and Physiology Semester 1 (AHNAX1A)

The anatomy and physiology in semester 1 for the bachelor of nursing students focuses on anatomical terms used regarding the body, the anatomical structures of all systems of the body, the location of major organs and cavities of the human body.

Anatomy and Physiology Semester 2 (AHNAY1A)

The anatomy and physiology in semester 2 focuses on the structure and function of the human body and focuses on regional anatomy which is the interrelationships of all the structures in a specific body region e.g. abdomen.

Anatomy and Physiology MODULE 1

This module attempts to provide a good introduction into Anatomy and Physiology. How structure and function of the body complement with one another in a normal, healthy human body. The concepts outlined in this module will help in understanding other modules in the field of Biomedical Technology.

Anatomy and Physiology MODULE 2

This module attempts to provide a better understating of structural body systems and functional metabolisms. How structure and function in the human body can be explained in terms of keeping conditions in the environment relatively constant. The concepts outlined in this module will help in understanding other modules in the field of Biomedical Technology.

Application Technology IV

Introduction to and use of most recent technology – Selection of software / hardware, testing, benchmarking and usage in applications.

Artificial Intelligence IV

Fundamentals of artificial intelligence – Concept Learning and the General-to-Specific ordering; Bayesian Learning; Fuzzy Logic Systems; Neural Networks; Support Vector Machines (SVM) and Decision Trees.

Acoustic Emission Testing Methods

Types of acoustic emissions, basic concepts, instrumentation and read out, signal description, background noise, inspection of pressure vessels, flaw location, inspection of wire ropes, inspection of welds, inspection of ceramic materials, brazed metal to ceramic bonds, inspection of composite materials, laboratory experiments.

Blood Transfusion Technology:

Blood Transfusion Technology is a module based immune-haematology, also sometimes referred to as blood banking. It is a branch of haematology which studies antigen-antibody reactions to understand the aspects of basic blood transfusion technology. The module includes concepts, procedures and techniques used by the South African Blood Transfusion service for determination blood groups, donor compatibility, transfusion hazards and the preparation of blood components.

Business Analysis II

Enterprise Information Systems; database design for each business process; business analysis and management; functional business systems; enterprise modelling and process modelling.

Business Analysis III

Analysis of an existing, established business and the documentation and logical design of a physical IT system according to the SDLC.

Business analysis project – Practical experience and the completion of a practical project in a work environment.

Cellular Pathology II (THEORY & PRACTICAL)

The module is a science that enables the assembling of diagnostic criteria used to recognize, evaluate and analyse the normal and abnormal cell content of specimens obtained from the Female Genital Tract for microscopic diagnosis.

Cellular Pathology III (THEORY & PRACTICAL)

The module is a science that teaches to assemble the diagnostic criteria used to recognize, evaluate and analyse the normal and abnormal cell content of specimens obtained from the Respiratory tract, Urinary tract and Serous cavities for microscopic diagnosis.

Chemical Pathology Module 1

The module is comprised of theory and practical in clinical chemistry. This module attempts to provide a good introduction of clinical chemistry. Enabling the better understanding of Laboratory safety, equipment's, fluids sample analysis, Quality control and quality assurance. The concepts outlined in this module will help in understanding Chemical pathology module 2 and 3 in the field of Biomedical Technology.

Cellular Pathology I (Theory & Practical)

The module that equip the students with theoretical knowledge and technical skills on the preparation of tissue specimen for diagnostic purposes.

Chemical Pathology 11 Theory (AHCHT2A)

Chemical Pathology 11 theory (also known as Clinical Biochemistry or Clinical Chemistry) is a level of study which seeks to bring a scientific and theoretical understanding of diseases (e.g. Hepatitis) and tests (e.g. liver enzymes) affecting various organs of a human body. The module entails biochemical analysis of human bodily fluids or specimens such as blood and through testing of disease markers which will enable facilitation of correct diagnosis, treatment and prevention of diseases.

Chemical Pathology 11 Practical (AHCHP2A)

Chemical Pathology 11 practical is intended to bring practical clarity to Chemical Pathology 11 theory. The module is a practical approach in understanding disease markers and application of techniques used in analysing tests on human bodily fluids which results are used to interpret disease status of a patient.

Chemical Pathology 111 Theory (AHCHT3A)

Chemical Pathology 111 theory is a branch of pathology with a specific focus on biochemical analysis of disease markers which affect human body. The theoretical approach entails understanding of minerals and trace elements, lipids, immunoassays and Pharmacology. The module is applied science which seeks to clarify the study of human body in various phases of health and diseases.

Chemical Pathology 111 Practical (AHCHP3A)

Chemical Pathology 111 Practical is a module intended to practically perform tests from specimens to bring more clarity on Chemical Pathology 111 theory. The practical application of laboratory techniques would bring about the necessary experience related to the module and the expertise required in a medical laboratory.

Chemical Quality Assurance

Introduction to research development and problem-solving skills; The research process; Planning and managing a research project; Interpretation of results; Introduction to quality in the analytical laboratory and Establishing a quality assurance programme.

Chemistry – Module 1

Measurements in chemistry; Atoms, molecules and ions; Formulas, equations and moles; Reactions in acqueous solutions; Periodicity and atomic structure; Ionic bonds and molecular structure; Chemical equilibrium and Aqueous equilibrium (acids and bases).

Chemistry – Module 2

Composition and structure of the atom; Structure and properties of ionic and covalent compounds; Calculations and chemical equations; Reactions in aqueous solutions; Energy, rate and equilibrium; Acids and bases and oxidation reduction; Saturated hydrocarbons; Unsaturated hydrocarbons (alkenes, alkynes and aromatics); Alcohols, phenois, thiols and ethers; Aldehydes and ketones; Carboxylic acids and derivatives and Amines and amides.

Communication

Organisational theory; communication techniques and written communication.

Computer Security IV

Principles of computer security – Cryptology (symmetric and asymmetric); Software; Virtual Private Networks (VPN); Public Key Infrastructure (PKI); VLANS; WEP; WPA; WPA2; Steganopgraphy; Watermarking; Certificate Authority (CA); Certificate Revocation Lists (CRL); Registration Authorities (RA); SSL and SET.

Corrosion Inspection and Monitoring Techniques

Corrosion and its cost in a modern world, corrosion detectability, maintenance, management and inspection strategies, corrosion monitoring, non-destructive evaluation, laboratory experiments.

Development Software I

Basic programming – Techniques; Structured and Object orientated programme design.

Development Software II

Object-Orientated design; Connect SQL Database using ADO.NET technology to Windows and ASP.NET forms; Integrate XML and XML Web Services with ASP.NET web pages in a Visual Basic NET environment.

Development Software III

Object-Oriented design and programming and data structures in a Java environment.

Development Software IV

Object-Oriented programming – Design and application of learner selected tools.

Eddy Current Testing – Theory

Scalars and vectors; Coordinate systems; Del ∇operator; Gradient of a scalar, $V = \nabla V$; Divergence of a vector, $A = \nabla . A$; Curl of a vector $\equiv \nabla \times A$; Laplacian operator ∇2; Gradient (Vector operators); Vector integration; Divergence; Curl operator; The vector differential operator; Differential vector identities (For any vector and scalar); Direction angles, Direction cosines; Review of complex numbers; Multiplication and division of a vector by a scalar; Addition and subtraction of vectors; Cartesian coordinates of a vector; The scalar or Dot product of two vectors; The line integral; The surface integral; The volume integral is given by; Vector or cross product of two vectors; The introduction to coordinate systems; Electromotive force; Electromagnetic induction; Alternating current principle; The nature of the sinusoidal functions; Application of ac voltage to resistors, inductors and capacitors; Kirchhoff's laws; Bridges; The frequency; Series LCR circuit; Instruments; Parallel LCR circuit; Resonance; Transients; Filter circuits; Power in ac circuits; The transformer; Eddy current testing circuits; Factors affecting eddy current; Depth of penetration; Coil connections; Eddy current flow characteristics; Transient eddy current testing for aging aircraft; Profiled eddy currents probes for complex shape examination; Multi-frequency flaw detectors; Test coils; Surface coils; Impedance Plane Analysis; Detailed discussion of eddy current testing; Eddy Current Inspection Techniques; Grain Structure; and Reference standards.

Eddy Current Testing – Practical

Introduction to Eddy Current Testing; Historical and developmental process; Basic physics and controlling principles; Product technology; Generalities on NDT; Terminology (EN 1330-1 and EN 1330-2 EN 1330-5); Fundamentals; Applications of eddy current testing; Eddy current testing system; General purpose application instrument; Specific application instruments; Probe functions; Probe family; Probe designs; Array probes; Pulsed eddy currents; Non inductive techniques; Magneto-Optical Imaging, SQUID, Giant magneto-resistance; Imaging; Modelling; Measurements; Output and signal display; Reference blocks; Mechanized equipment; Probes; Factors affecting choice of sensing elements; Selection of inspection parameters; Frequency; Coil drive; Hall element drive; Channel gain; Display sensitivity selections; Standardization; Filtering; Thresholds; Readout mechanisms; Calibrated or un-calibrated meters; Impedance plane displays; Data recording systems; Alarms, lights, etc.; Numerical readouts; Marking systems; Sorting gates and tables; Cut-off saw or shears; Automation and feedback; Information on the product; Information on test conditions; Preparation of written instructions; Use of other NDT methods; Reference blocks; Operating conditions; Calibration curves; Settings; Evaluation; Reporting; User standards and operating procedures; Inspection system output; Accept/reject criteria; Signal classification processes; Detection of signals of interest; Flaw sizing techniques; Calculation of flaw frequency; Sorting for properties related to conductivity; Thickness evaluation; Measurement of ferromagnetic properties; Personnel qualification (according to EN 473 and ISO 9712); Equipment verification; Written instructions; Format of working procedures; Traceability of documents; Other NDT qualification and certification systems; and A review of applicable NDT application and product standards.

Electromagnetic Testing Techniques

Introduction, fundamental theory, magnetic methods, eddy currents: principles, eddy current methods, microwave methods of testing, miscellaneous methods, Barkhausen effects, laboratory experiments.

Expert Systems IV

Fundamentals of expert systems – Problem representation; Knowledge acquisition and validation; Inferences and Uncertainty in knowledge-based systems.

Financial Accounting I

Introduction to Accounting; books of prime entry; the ledger; fixed assets; stocks; debtors; creditors; control accounts; results of operations and financial positions; elementary analysis and interpretation of financial statements; clubs and non-profit organisations and introduction to partnerships.

Financial Accounting II

Advanced partnerships; company accounting; close corporations; incomplete records and correction of errors; funds statement and cash flow statement; insurance claims; analysis and interpretation of financial statements (intermediate); royalty accounting; contract accounts and branch accounting.

Financial Information Systems II VBA

Excel basic operations, functions and formulas, simple VBA programs with Excel, program control, Arrays.

Financial Information Systems III VBA

More advanced VBA programming with Excel, macros, VBA and Access, SQL, Data validation and error trapping, Programming with ADO.

Financial Management

Basic financial management; principles of budgeting; principles of managerial finance; introduction to financial statements; forms and sources of financing.

Fracture Mechanics

Introduction, structure and deformation in materials, survey of engineering materials, mechanical testing: tension test and other basic tests, review of complex and principal states of stress and strain, yielding and fracture under combined stresses, fracture of cracked members, fatigue of materials: introduction and stress-based approach, stress based approach to fatigue: notched members, fatigue crack growth, strain-based approach to fatigue, time-dependent behaviour: creep and damping, laboratory experiments.

Haematology II:

The module is one of two modules based on the study of blood. After completion of this module the student will be able to understand and apply basic haematology concepts and principles, assemble the diagnostic criteria used to identify and classify erythrocytes, haemoglobin disorders, anaemia, platelets and coagulation & bleeding disorders. These concepts aid in haematological evaluation leading to an accurate interpretation.

Haematology III

The study of blood continues in Haematology III. The module covers basic haematology concepts and principles, diagnostic criteria used to identify and classify leucocytes, leukocytes disorders and leukaemia. These concepts aid in haematological evaluation leading to an accurate interpretation of haematological specimens.

Immunology:

This module is based on the study of the molecular and cellular components of the immune system. It includes diagnostic techniques used in immunology, antigen-antibodies reactions and complement. This information forms a base for the body's immune response in a wide range of human diseases. Thus, it is an integral part of life science.

Information & Technology Management IV

Web management; data administration and database systems.

Information Systems I

Introduction to computer concepts, hardware, programming, SDLC, impact of computers on society and DBMS principles. Relational database design and basic implementations of database.

Information Systems II

Systems analysis; design and development; using SQL and PL / SQL; SDLC; basic project management and DBMS principles.

Information Systems III

Advanced database systems (ORACLE) and Project Management.

Information Technology Skills I

Basic IT skills – Entrepreneurial skills; Inter personal communication skills and legal aspects.

Inorganic Chemistry II

An introduction to chemical bonding; Advanced study of ionic bonds; Covalent bonding and molecular structure; Chemical reaction in aqueous solutions; Solvent for non-aqueous solutions; Redox chemistry; Group A elements and Hydrogen.

Inorganic Chemistry III

Bonding; Ligand field theory; Descriptive chemistry of transition elements and Nuclear chemistry.

Inorganic Chemistry IV

Advanced atomic structure; Molecular structure and bonding; Molecular symmetry; Advanced d-metal complex; Electronic spectra; Reaction mechanism of d-metal complexes; Main group organo-metallic compounds; d and f organo-metallic compounds; Catalysis and Descriptive industrial chemistry.

Introduction to Fracture Mechanics

Difference between stiffness and strength; Mechanical properties of materials; Shearing stress and strains; Tensile testing; Composite materials; Examples of how to use formulae in this chapter; Failure rate; Modes of failure; Modes of fracture; Stress concentration effect of flaws; Griffith's theory; Brittle fracture; Ductile fracture; Relationship between energy rate and stress field approaches; Theoretical tensile strength; Theoretical shear strength; Stress intensity factor; Toughness; Fracture toughness; Crack opening; Stress approach (Fracture Mechanics); Stress concentration effect of flaws; Stress concentration factor; Geometric stress concentration factor; Stress intensity factor; Impact toughness; Theoretical shear strength; Cohesive strength; Factors affecting crack propagation; Crack growth and fracture; Some nonlinear aspects of fatigue crack propagation; The Paris-Erdogan equation; The Paris crack growth rate law; Application to quality control of materials and fabrication; Monitoring of fatigue crack length; Fatigue methodology; Mechanisms; Paris Law; Fibers and matrix; Advanced composite materials; Laminate theory; Shear buckling; Fiber-reinforced composites; Manufacturing and in-service damage; Adhesives; Sandwich structures; Joining polymer matrix composites and resin matrix composites; Bonded against bolted joints; Mechanical fastening; Non-destructive testing methods; Types of forging processes; Statistics; Weibull statistics for failure; Strength analysis; NDT hardness testing; Impact testing; The characteristics of creep; Creep and creep testing; Creep parameters; Stress state in cylindrical pressure vessel; Manufacture technology of pressure vessel; Geometry of considered pressure vessels; Stress intensity factor for a through-cracked cylindrical pressure vessels; Fracture toughness; Hooke's Law; Practical applications; Fatigue; Maintain a chain of custody; Photos and other records; Examination in your laboratory or service laboratory; Storage; Deposition; Pre-trial preparation; Trial testimony; Cross-examination; and The technical report.

Introduction to Medical Technology (AHMTA1A)

Introduction to Medical Technology is a module that deals with the basic concepts of Medical Laboratory science. It exposes the students to glassware and apparatus used in a laboratory. The basic concepts of medical law and ethics enable the student to understand the necessary attributes required from students entering the field. Career pathing and work conditions is a part of the module which is intended to put the learner in pole position to make an informed decision regarding Medical Technology as a career.

Introduction to Non-Destructive Testing – Theory

Measurement; SI Unit; List of symbols; Conversion factors; Non-destructive Testing at Vaal University of Technology; Programme requirements; Levels of NDT certification; Matter and mass; Atoms; Ions; Attraction of charged particles; Atomic number; Metals and non-metals; Neutrons and isotopes; Radioisotopes; Radiant energy or electromagnetic radiation; What is Non-destructive testing? Applications of NDT? When is NDT needed? NDT Methods; Visual inspection; Liquid Penetrant Testing; Eddy Current Testing; Magnetic Particle Testing; Magnetic Flux Leakage (MFL); Radiographic Testing; Ultrasonic Testing; Ground Penetrating Radar; Accidents or hazards; The concept of using an NDT instrument; The process of developing pure science into NDT solutions; Operational definitions of hardness; Testing of large structures; Destructive software testing; Resistance welding; New developments in welding; Weld joints; Weld defects; Properties of metals; Manufacturing; Effects of welding; Heat-treating; Reasons for testing welds; Quality control; Testing of welded joints; Destructive testing; Differences between destructive and non-destructive techniques; Casting steel; Forging techniques; Machining process; Diagrams displaying welding process; What is Ground Penetrating Radar?; Electromagnetic energy; Principle of GPR; GPR reflected and transmitted signals; Requirements for void testing; Limitations of GPR; Image processing to detect the signal and size of a void; Interpretation of GPR; Safety; Examples of structure inspection; Sample space and events; Probabilities on events; Conditional probabilities; Probability of detection; Stress and strain; Elements of fracture mechanics; Environmentally assisted cracking in metals; Hardness testing; Engineering materials; Cracks; What is a signal?; Transducers and sensors; Different categories of electrical signals; Time-domain and frequency-domain; Analog and digital signals; What is digital signal processing?; Sampling; The Decibel unit; DSP applications; Mathematical definition of a signal; Comparison between digital signal processing over analog signal processing; Some special basic discrete signals; and Pulse characteristics.

Introduction to Non-Destructive Testing – Practical

Mineral-based material; Metallic material, including welds; Organic-based materials; Other materials and products (employer defined); History; Terminology; Use of visual testing as a complement to other NDT methods; Applications; Personnel qualification and certification; Relevant standards; Fundamentals; Photometry; Vision; Lighting; Electromagnetic radiation; Visible wavelengths; Fundamentals of light; Light measurement; Luminance; Optical principles; Visual perception; Material attribute affecting the test; Environmental factors and physiological factors; Comprehensive knowledge and understanding of the physical principles and physics of light including; Optical performance; Types of light sources, natural, artificial including laser; Details of the eye including; Camera and photo sensor operation and principles; Principles of operation of fibre bundles and lenses; Photogrammetry; Advantages and limitations; Outline of basic flaws detectable by VT as necessary to work in a specific sector; Including cladding and buttering; Material composition; In-service aspects; Capability and limitations of VT; Detect ability; Associated techniques; References; Evaluation of surfaces; Roughness and waviness; Definition of shape and geometry of flaws; A comprehensive understanding and knowledge of manufacturing process and associated metallurgy and flaw types, etc.; A comprehensive understanding and knowledge of the cause and formation of in-service defects including associated metallurgy and flaw types, etc.; Introduction to, and applications of, equipment introduction to equipment; Pre-test documentation (EN 13018); The development and application of verification techniques including the demonstration of procedures and instruction of

effectiveness.; A thorough knowledge of complementary NDT methods that may be referenced in written procedures; Equipment variables affecting test results including type and intensity of light; Material variables affecting test results including the variations of surface finish; Discontinuity variables affecting test results; Determinations of dimensions (i.e., depth, width, length, etc.); Sampling/scanning procedure variables affecting test results; Process for reporting visual discontinuities; Personnel (human factors) variables affecting test results; Detection; Selection of parameters; How to setup and calibrate a test; Diagrams and drawings; Raw materials; Primary process materials; Joining processes; Fabricated components; In-service materials; Coatings; Other applications; Evaluation and disposition criteria; Audio/video-requirements; Reporting the results of tests; Technique reports; Data reports; Image recording methods; Personnel qualification (according to EN 473 and ISO 9712); Developments; Safety and health; Activities; Defect rectification, removal and repair; Quality; Management and leadership; Core values; Strategic quality planning; Customer satisfaction; Customer feedback; Problem-solving; Continuous process improvement; Deming's points; NDT personal and academic traits sought by employers; Factors that can lead to rejection of employment; Factors that may lead to termination from a job; Records keeping and testimony; Communication; Team work; Problem solving; Initiative and enterprise ; Planning and organizing; Self-management; Learning; and Technology.

Liquid Penetration Testing – Theory

Difference between liquids and gases; Force and mass; The international system of units (SI); SI unit prefixes; English gravitational unit system; Density; Relatively density; Specific weight; Specific gravity; Principles in hydrostatics; Three phases of matter; The hydrostatic equations; Incompressible fluids; Mercury barometer; Compressible fluids; Pressure across a flat fluid/fluid interface; Pascal's law; Hydrostatic paradox; Principle of Archimedes; Stationary flow; Continuity principle, Bernoulli's equation; Application of Bernoulli's equation, Viscosity; Physical phenomena underlying penetrant testing; Contraction of a liquid surface; Free energy of the surface of a liquid; Contact angles; The spreading of liquids on solids or liquid surface; Surface energy versus surface tension; Interphase tension; Pressure at a curved surface; Introduction to bubble dynamics; Bjerknes forces; Capillarity; Dissolution (dissolve); Adsorption; Capillary condensation; Adhesion (cling); Cohesive and adhesive forces; Relation of surface energy to bonding; Anisotropy of surface energy; Structural features of liquid crystals; Characterization of liquid crystals; Applications of liquid crystals; Defects; Properties of the order parameter tensor; Three types of liquid crystals; Diffusion; Fick's first law; Fick's second law of diffusion; Solution of Fick's 2nd law; Mechanisms of diffusion; Defects penetrated by liquids; Blind capillaries; Advantages of the penetrant testing; Re-deal wash burn equation; The effect of non-circular cross section; Entrapped air; Effect of fluid elasticity; Colour; Dyes; Codes; Standards; specification; Procedures; Defect rectification; Removal and repair; Quality management and leadership; Core values; Strategic quality planning; Customer satisfaction; Customer feedback; Problem-solving; Continuous process improvement; Deming's point; NDT personal and academic traits sought by employer; Factors that can lead to rejection for employment; Factors that may lead to termination from a job; and Records keeping and testimony.

Liquid Penetration Testing – Practical

Practical sessions; Laboratory periods; Welding process; Casting process; Processes of rolled bars; Indication from cracks; Discontinuities inherent in various materials; Discontinuity categories; Processing discontinuities; Service discontinuities; Influence of manufacture and material; Effects of metal smearing; Brief history of Non-destructive testing and liquid penetrant testing; Purpose of liquid penetrant testing; Method of personnel qualification; Terminology; Why penetrant inspection improves the detectability of flaws; Physics of how penetrants work; Proper selection of PT as method of choice; Liquid penetrant processing; Types of penetrants; Characteristics of penetrants; Verification that the test object is in suitable condition for testing; Factors affecting indications; Written procedure with check reports; Effects of test object factors on process; Design and operation of penetrant installation and units; Materials for liquid penetrant testing; Environmental and safety conditions (Material safety data sheets (MSDS); Light sources; Measuring units and reference blocks (EN 3452-3 and EN 3452-4); Ultraviolet Light Safety; Information about the test object, prepare written instructions according to EN 1371-1, EN 571-1 EN 10228-2, EN 1289; Calibration ;Assessment of discontinuities; Evaluation of indications on metallic materials and non-metallic materials; Testing and maintenance materials Personnel qualification (according to EN 473 and ISO 9712); Equipment verification; Test material control samples; Penetrant tests; Quality control of wash temperature and pressure; Quality control of drying process; Quality control of lighting; Advantages and disadvantages of penetrant testing; Inspection procedures (minimum requirements); Standards/codes (Current ASTM and ASME standard methods-ASTM E165, E 1208, E 1209, E 1210, and E1417); Applicable method/processes (Characteristics of each method and general applications of each method; and Acceptance criteria.

Magnetic Particle Testing – Theory

Induced magnetic fields; Circular and longitudinal fields; Advantages and disadvantages of MPT; Gradient (Vector operators); Vector integration; Curl; The vector differential operator; Differential vector identities (For any vector $\vec{F}$ and scalar φ); Direction angles, Direction cosines; Mathematical preliminaries; Coordinate systems; Cartesian coordinate system; Del (∇) operator; Gradient of a scalar, $V(=\nabla V)$; Divergence of a vector, $A(=\nabla.A)$; Curl of a vector $(\equiv \nabla \times A)$; Laplacian operator (∇^2); Determinants; Matrices; Permutations; Basic series; Exponential series; Sine and cosine series; $Sin\ h$ and $Cos\ h$ series; Hyperbolic functions; Sine, cosine, tan and cot functions; Partial derivative; Some differentiation formulae; Some useful integration formulae; Integral theorems; Divergence theorem; Magnetic fields; Magnetic pole; Lines of force; Magnetic effects of steady currents; Magnetic flux density and magnetic field intensity; Magnetic moment; Force in magnetic field; Magnetization and amperian current distributions; Magnetic field produced by a magnetic material; Magnetic pole density; Magnetic field intensity; Ampere's circuital law; Demagnetization; Magnetic circuits used in inspection; Current requirements for MPT; and Forces on particles.

Magnetic Particle Testing – Practical

History; Applicability and limits; Terminology (EN 1330-7) associated with Magnetic particle testing; Product technology; Effect of discontinuities of material; Effects of discontinuities on materials; Theory of magnetic fields; Theory of magnetism; Electric circuits; Magnetic circuits; Magnetic field created by electric circuits; Flux fields; Nonmagnetic materials; Magnetic materials; Bar magnet; Ring magnet; Magnetic fields characterization and measurements; Inspection materials; Influence of the interface between a magnetic medium and a nonmagnetic medium; Influence of the orientation of the discontinuity on magnetic flux; Behaviour of a magnetic particle in the vicinity of a magnetic flux; Influence of geometry (depth, thickness and orientation) on detectability; Magnetic properties of principal ferromagnetic alloys; Principles of magnetic particle testing; Equipment selection considerations; Manual inspection equipment; Medium-and heavy-duty equipment; Mechanized inspection equipment; Portable type; Stationary type; Multidirectional units; Liquid requirements as a particle vehicle; Ultraviolet radiation and fluorescence; Light sensitive instruments; Magnetizing equipment; Viewing condition; Measurement and calibration; Sources of light and conditions of illumination; Accessories; Considerations on the choice of the equipment (EN ISO 9934-2 and EN ISO 9934-3); Current flow technique; Identification or designation material; Preparation of written instructions; Presentation of the standards and codes ; Testing according to written instructions; Use of standards e.g., ASTM E 1444, E 709; Defect appraisal; Manufacturing process; Possible causes of defect; Use of part; Acceptance and rejection criteria; Use of tolerances ; Magnetic particle test indications and interpretations; Effects of discontinuities on materials and types of discontinuities indicated by magnetic particle testing; Preparation of the parts and influence of the surface quality; Means of magnetization; Values of the parameters; Continuous or simultaneous method; Remanence method; Flux indicators; Choice of the detection media products indicators; Treatment of components after test; Demagnetization; Principle, minimal value of the magnetic field of demagnetization, frequency, effect of skin and calculation of magnetizing coil; Level of residual field according to the later use of material; Influence of terrestrial magnetic field; Cleaning of the components; Test report ; Basics of evaluation, viewing conditions (EN ISO 3059) according to reference block, other used reference blocks, calibration of test units, Report of simple welding, forging, rolled products and casting; Imperfections Report of imperfections according to EN 1290, EN 1369, EN 10228-1; Evaluation and verification of the indication quality; Circular field; Longitudinal fields; Precautions-safety and overheating; Contact prods and yokes; Discontinuities commonly detected; Selecting the proper method of magnetization; Principles of demagnetization & procures; Classification of the indications; Report of simple welding, forging, rolled products and casting imperfections; Malfunctioning of equipment; Proper magnetic particles and bath liquid; Bath concentration; Tests for ultraviolet radiation intensity; Personnel qualification (according to EN 473 and ISO 9712); Equipment verification; Traceability of documents; A review of applicable NDT application and product standards; Format of working procedures; Other NDT qualification and certification systems; Precautions for ultraviolet radiation; Health and safety; Safety data sheet; Harmfulness and toxicity of the products; Treatment and rejection of the effluents, environmental conditions; Fire hazards; Risks related to the ultraviolet radiations and; and Laboratory work.

Microbiology 3A AHMMT3A &AHMMP3A

This field of microbiology encompasses the epidemiology, pathogenesis, pathology and laboratory diagnosis of bacteria that causes diseases such as tuberculosis, listeriosis, cholera etc. It also includes the determination of the sensitivity and mechanisms of antibiotic resistance.

Microbiology 2A AHMMT2A &AHMMP2A

This covers the diseases that are caused by viruses (e.g. HIV and rabies), parasites (e.g. malaria and bilharzia) and fungi (e.g. thrush and ringworms). Epidemiology, pathogenesis, pathology, laboratory diagnosis and treatment are covered

Microbiology Semester 1 (AHNMB1A)

Microbiology focuses on microbial transmission and reproduction. The principles of infection control and the role of the immune system.

Microbiology

The module is the study of microorganisms, such as bacteria, viruses and fungi. It includes the physiology, cell biology and clinical aspects of microorganisms. It also includes the various techniques used to identify and isolate and control the organisms.

Molecular Biology

The module is the study of biology or science at molecular level. It deals with the structure and function of DNA, RNA and proteins as well their interactions in cellular processes

Networks IV

Advanced networking concepts – Standards; Hardware; Protocols; Topology; All seven layers and practical application.

Non-Destructive Testing Project (Numerical Methods and Matlab Applications)

Choosing a project; Steps to be followed; Finishing on time; Writing a report; Project report format; Getting started; Prose; Style considerations; First versus third person; References; Plagiarism; Get organized; Categories of NDT modelling; A brief history of some aspects of NDT modelling; The modelling process; Mathematical model; The solution of nonlinear equations $f(x) = 0$; Fixed point interaction; Bisection method; New-Raphson method; The solution of linear systems $Ax = B$; Gaussian elimination; LU factorization; Cholesky factorization; Gauss-Seidel method; Inverse matrix; Interpolation and polynomial approximation; Cubic splines; Hermite polynomial; Chebshev approximation polynomial; Numerical differentiation; Differentiation of the Newton polynomial; Richardson extrapolation; Numerical integration; Trapezoidal rule; Composite Trapezoidal rule; Newton-Cotes integration; Gauss-Legendre Two-point rule; Monte Carlo integration; Euler's method for ODE's; Runge-Kutta method Finite difference method; Four windows of Matlab; Vector variables; A minimum Matlab session; Tutorial lessons; Basic plotting; Entering a matrix; Matrix indexing; Colon operator; Linear spacing; Colon operator in a matrix; Creating a sub-matrix; Deleting row or column; Dimension; Continuation; Transposing a matrix; Concatenating matrices; Matrix generators; Special matrices; Solving linear equations; Matrix inverse; Matrix functions; M-File scripts; M-File functions; Input to a script file; Output commands; Control flow; Saving output to a file; Debugging process; Correcting the ending debugging; Ending debugging; Correcting an M-file; Defining vectors in Matlab; Vector Transpose; Computing the outer product in Matlab; Diagonal matrices; Identity matrices; Matrix inverse; Symmetric matrices; Reflection coefficients; and Design of absorbers.

NDT Project IV

This project will involve multi-disciplinary industrial projects in NDT subjects in which the findings will be communicated through a written report. Most of the work will be including Matlab calculations

Numerical Analysis with Matlab Applications

An introduction to Matlab, linear equations and eigensystems, roots of equations, differentiation and integration, differential equations, boundary value problems, fitting functions to data, optimisation methods, Matlab fundamentals.

Operating Systems IV

Introduction to operating systems – Resource sharing; Memory management; Multi-programming and Case study (single and multi tasking).

Optical Testing Methods

Devices for surface and size testing, photometrical techniques of sizing, photoelectric measuring microscope, photoelectric autocollimator, laser scanning microscope, microscope with image camera tube, holographic technique of transparent material structure analysis, endoscopes, interference systems of testing, laser flaw detectors, fiber-optic devices of testing, error analysis, principles of photoconductivity, simple models, impurities, principles of luminescence, laser principles, laboratory experiments.

Organic Chemistry II

Polar covalent bonds; Organic compounds – Alkanes and cyclo alkanes; Overview of organic reactions – Alkenes, Alkenes and alkynes and Armatic compounds.

Alkyl halides; Alcohols, ethers and phenols; Aldehydes and ketones – nucleophillic addition reactions; Carhooxylic acid and derivatives and Amines.

Organic Chemistry III

Hybrid orbitals; Stereochemistry and comformational analysis; Acids and bases; Nucleophilic reactions at unsaturated carbon; Nucleophilic substitution at saturated carbons; Elimination reaction; Electrophilic and nucleophilic aromatic substitutes; Carbohydrates; Amino acids, peptides and proteins; Radicals; Determination of organic structure; Polynuclear aromatic compound and Fats, oils and waxes.

Organic Chemistry IV

Application of spectroscopy in organic chemistry; Combined structure problems; Aspects of energy and raw material supply; Chemicals from ethylene and / or Acelylene and Polymerisation

Penetrant Testing Methods

Basic principles of Penetrant testing, penetration of liquids into defects, spreading of Penetrant along the surface, hydrodynamics of the developing process, visual recognition of indications, outlook for further developments in Penetrant testing, laboratory experiments.

Physical Chemistry II

Gases, liquids and solids; Solutions and their properties; Chemical kinetics; Acid-base equilibria and Electrochemistry.

Physical Chemistry III

Chemical thermodynamics; Change of phase; Electrochemistry; Reaction kinetics; Solid state chemistry and Surface chemistry.

Physical Chemistry IV

Thermodynamics; Entropy; Quantum mechanics; Molecular spectroscopy; Advanced kinetics and Surface chemistry.

Physics I

Introduction (S1 units and conversion); Waves and sound; Introduction to vectors; Kinematics in one and two dimensions; Forces and Newton's law of motion; Work and energy; Impulse and momentum; Electricity; Fluids; Temperature, heat and the transfer of heat; Electric forces, fields, potential energy and circuits; Reflection, fraction and interference of light; and Nuclear physics and radioactivity.

Physics II – Theory

Electric circuits (alternating current, Kirchhoff's Rules, RCL Circuits); Magnetic forces and magnetic fields; Electromagnetic induction; Fluids (Archimedes principle, Poseuille's Law); Thermodynamics; The ideal gas law and kinetic theory; The nature of the atom; X-rays; Lasers; Ionising radiation; Nuclear energy and elementary particles; Dynamics of uniform circular motion; Rotational kinematics; Rotational dynamics; Simple harmonic motion and elasticity

Physics II – Practical

Experiments are in-line with the theoretical content.

Force constant of a helical spring; Static versus dynamic method; the mass of a ruler using torque; Relative density of a liquid by application of Archimedes' Principle; The influence of pressure difference on flow rate; the effective capacitance of two capacitors in series of two capacitors in parallel; the time constant and half-life of a RC-circuit (resistor – capacitor capacitor).

Project IV

Student selected industry project – Literature study and application.

Project Management IV

Consist of advanced project management concepts, based on the PRINCE2 methodology, mainly used in the commonwealth countries. Comprising the twelve main project process, it covers the whole project life-cycle, from initialisation to final project completion and review. Assessments are based on practical project assignments, specifically based on real world problems encountered in software development projects. Class group discussion groups are also used extensively to allow students to practice the prescribed project management concepts and techniques in the PRINCE2 methodology.

Radiographic Testing – Theory

History of radiographic testing; Measurements and units; Periodic table; Protons, Electrons; Ions; Neutrons; Atomic number; Atomic mass; Nucleon number; Isotopes; X-rays; Beta-rays; Gamma-rays; Alpha decay; Beta decay; Gamma decay; Half-life; Radio-active decay; Radiation detectors; Nature of X-rays; Nature of Gamma-rays; Making a radiograph; Intensifying screens; Scattered radiation; Types of film; Production of X-rays; The X-ray tube; Cooling; Focal-spot size; Effects of Kilovoltage; Flash X-ray machines; High-voltage equipment; Application of various types of X-ray apparatus; Principles of radiography (Geometric principles); General principles; Radiographic shadows; Application to radiography; Calculation of geometric unsharpness; Pinhole projection of focal spot; Radiation emitted by source; Inverse square law; Radiation absorption in the specimen; Exposure factor; Determination of exposure factors; contrast; Choice of film; Radiographic sensitivity; Multiple film techniques; Effects of processing; Lead foil screens; Lead oxide screens; Fluorescent screens; Cassettes and film holders; Reduction of scatter; Mottling caused by X-ray diffraction; Scattering in 1 – and 2 – million-volt radiography; Multimillion-volt radiography; Relations of Millioamperage (source strength), distance, and time; The reciprocity law; Logarithms; Photographic density; Densitometers; X-ray exposure charts; Preparing an exposure chart; Gamma-ray exposure charts; The characteristic curve; Use of the characteristic curve; Graphical solutions to sensitometric problems; Sliding scales for exposure charts; Estimating exposures for multithickness specimens; Use of multiple films; Limitations of exposure charts; Subject contrast; Film contrast; Film graininess, screen mottle; Penetrameters; Viewing and interpreting radiographs; Selection of films for industrial radiography; Film packaging; Handling of film; Identifying radiographs; Shipping of unprocessed films; Storage of unprocessed film; Storage of exposed and processed film; Commercial keeping; Additional storage suggestions; General considerations; Manual processing; Automated film processing; Film radiographs; Equipment and materials; General aspects; Technique; Processing area; General considerations; Intensification of underexposed radiographs; Removal of fixing agents; Testing for fixer removal; Removal of one emulsion from double-coated film; Tray processing; Silver recovery from fixing solutions; In motion radiography; Radiography of radioactive materials; Depth localization of defects; Thickness measurement; High speed radiography; Geometric enlargement; Neutron radiography; Autoradiography; Duplicating radiographs; Fluoroscopy; Photofluorography; Microradiography; Electron radiography; X-ray diffraction; Advantages of paper radiography; Applications for paper radiography; Factors affecting paper radiography; Exposure techniques; Processing techniques; Stabilization processing; Automated processing; Manual processing; Viewing paper radiographs; Interpreting paper radiographs; The characteristic curve; Density-exposure relation; Reciprocity law failure; Effect of development time on speed and contrast; X-ray spectral sensitivity; The Gurney-Mott theory; X-ray latent image; Development; Radioactive materials; Interaction of radiation matter (Photoelectric effect, Compton scattering, Pair production); Radiographs; Exposure techniques; Radiographic safety principles; and Film interpretation.

Radiographic Testing – Practical

Manufacturing processes and associated discontinuities, History and discovery of radioactive materials; Fundamental properties of matter; Radioactive materials; Types of radiation; Principal methods of detection of X-rays; Limiting wave length of X-rays; Scattered radiation; Properties of radiation; Radiographic safety principle review; Photon; Energy; Principle of radiography; Advantages of radiography; Disadvantages of radiography; Basic equations; Geometric exposure; Exposure devices and radiation sources; Generation of X-radiation; Advantages of gamma rays over X-rays; Disadvantages of gamma rays over X-rays; Gamma radiation; Atom; Interaction of radiation with matter; Build up factor, Radiographic safety principle review; Energy; Principle of radiography; Advantages of radiography; Disadvantages of radiography; Geometric exposure; Exposure devices and radiation sources; Generation of X-radiation; Advantages of gamma rays over X-rays; Gamma radiation; Theoretical concepts; Principle of transfer analysis; Quantitative measurements using a near mono-energetic X-ray sources; Design of operation of X-ray machines; Design and operation of gamma ray devices; Information about the test object and national requirements; Testing conditions; Applicable standards; Standard assigned to the test object; Preparation of written instructions; Selection of standards for specific test applications; Product specific standards for special industrial sectors; Working with exposure charts; Film handling, Loading and processing; Darkroom facilities, Techniques, and processing; Exposure techniques; Radiography; Fluoroscopic Techniques; Radiographic image quality; Radiographs; Properties of film systems screens and digital detection systems; Influence on detectability; Radiographic viewing; Standards, codes, and procedures for radiography; Evaluation of castings; Evaluation of weldments; Test report; Check of test report; and Feasibility of test report.

Radiographic Testing Techniques

Radiographic interpretation, digital radiographic imaging, computed tomography, image data analysis, backscatter imaging, special radiographic techniques, neutron radiography, radiographic testing of metal castings, radiographic testing of welds, radiographic testing in utility, petroleum and chemical industries, aerospace applications of radiographic testing, laboratory experiments.

Research Methodology IV

Theory and practise of conducting research – Types of investigations selection of topic, title, coming up with a problem statement and a thesis statement, coming up with a research strategy, learn how to read a scientific paper and how to test if a topic is researchable, intellectual property rights, learn how to write funding applications. The Gantt Chart, statistical methods, research design and proposal.

Research Methodology

Application of research methodology principles in proposal writing, scientific writing skills and article analyses. (Additional content)

Signal Processing

A concept of a signal; Time domain and frequency domain; Notation; Digital and analog signal processing; Sampling; The Decibel unit; Quantization error and noise; Some special basic discrete signals; General cases of sinusoidal signals; Operations on sequences; Crucial results in discrete-time signal theory; The discrete Fourier Series; Orthogonal functions; Relation to discrete-time Fourier transform; Transformers; Continuous-time Fourier series; Fast Fourier Transform; Properties of time-domain impulse functions; The properties of frequency-Domain Impulse Functions; Periodic Signals; Unit-step function; Correlation as a sliding, windowed operation; A mathematical definition for correlation; Construction of a filter from a continuous function; Correlation; Convolution; Discrete convolution; A convolution model for ultrasonic pulse–echoes; The window functions; Parseval's formula for periodic signals; Deconvolution algorithms and practical considerations; Wiener filtering; Spectral extrapolation; Optimum Wiener filters; Curve-filtering methods; L_2 Deconvolution; L_1 Deconvolution; Sparse deconvolution; Minimizing the cost function; Spiking deconvolution; Predictive deconvolution; and Surface-consistent deconvolution.

Software Engineering & Design IV

Software engineering methodologies. Testing of systems and user interface design.

Strategic Information Systems IV

Theory and application of strategic information systems.

System Software I

CISCO IT Essentials: The IT Essentials: PC Hardware and Software curriculum provides an introduction to the computer hardware and software skills needed to help meet the growing demand for entry-level information and communication technology (ICT) professionals. The curriculum covers the fundamentals of PC technology, networking and security and also provides an introduction to advanced concepts.

System Software II

(CISCO) – CCNA Discovery Course: networking for home, small businesses and ISPs. The course provides a hands-on introduction to networking and the Internet using tools and hardware commonly found in the home and small business environments. The students will also cover an introduction to routing and remote access, addressing and network services. They are also familiarised with servers providing e-mail services, web space and authenticated access.

Thermographic Testing Techniques

Getting started with thermography for nondestructive testing, introduction to thermal emission, introduction to heat transfer, infrared sensor and optic fundamentals, images, automated image analysis, IR thermography, IR detectors for thermographic imaging, getting the most from the IR camera, filters, ultra-high-speed thermography, laboratory experiments.

Ultrasonic Testing – Theory

Modes of ultrasonic waves; Flaw detection on tubes and bars; Curved surfaces; Pipe and pipe line inspection; Advantages of ultrasonic testing; Limitations of UT; Sound Velocity; Sound in solids, liquids and gases; Wave characteristics; Pulse characteristics; Doppler principle; Resonance and anti-resonance; Ultrasonic wave equation; Reflection and transmission; The law of refraction; Boundaries; Embedded layers; Guided waves; The physics of bulk wave radiation; Waves in three dimensions; Generating a narrow beam at low frequencies; Bulk wave equations; Bulk wave background; Equation of continuity; Wave equation for sound propagation in fluid; Energy; Acoustic pressure and specific acoustic impedance; Continuity equation; Force equation; Linear continuity equation; Linear force equation; Linear wave equation; Velocity potentials; Sound speed values; Surface wave velocity (Rayleigh wave velocity); Derivation of a wave equation for bulk material; Dispersion; The Rayleigh wave equation; Uses of surface waves; Lamb wave theory; Love waves; Isotropic surface; Measurement of Poisson's ratio; Newton's laws and Hooke's law; Simple undamped oscillators; Damped oscillator; Forced damped oscillator; Resonance; Dirac delta function; Fourier series; Non-periodic waves; Wave motion; Harmonic waves; Dispersion, group velocity and wave packets; Decibel notation; Decibel scale of attenuation; Utilizing the attenuation; Relaxation time formulation for viscosity; Beam attenuation; Physical characteristics of attenuation; Point source; Ultrasonic beam characteristics; Ultrasonic transducers; Piezoelectric transducers; Transducer characteristics; Ultrasonic circuitry for piezoelectric transducers; Beam characteristics; The propagation of longitudinal waves in piezoelectric materials; Composite piezoelectric material; The shape of the piezoelectric disc; Driving pulse shape; Ultrasonic beam modification techniques for piezoelectric probes; and Diffraction.

Ultrasonic Testing – Practical

Practical sessions; Laboratory periods; Various defects related to the manufacturing processes and service-induced defects related to the defined sectors; Heavy forgings; Worked parts of machines; Railway material; Plate and strip; Semi-finished products: Rods, billets and wires; Casting; Welded Joints; Joints produced by riveting, gluing and shrinking; Non-metallic specimens; Composite structures; Bounded structures; Miscellaneous product forms as applicable (rubber, glass, etc.); Task of non-destructive testing – Personnel; History of NDT; Terminology of NDT (EN 1330-1 and EN 1330-; Terminology of UT (EN 1330-4); History of ultrasonic testing; Applications of ultrasonic testing; Overview of standards: ISO, (EN 583-1 to EN 583-6 and EN 14127)and national (general, and products); Responsibilities of levels of certification; Review of mathematical basics ;Various types of wave modes; Near and far fields The piezoelectric effect; Ultrasonic transducers; Single crystal zero compression probe; Twin crystal probes; Transducer materials; Transducer type search unit; Transducer groups; Immersion probes; Main groups of flaws in materials; Four facts of testing; Golden rules for NDT; Application of ultrasonic testing; Features of ultrasonic testing; Examples of capabilities of UT; Examples of limitations; Requirements for UT; Ultrasonic vibrations; Characteristics of ultrasonic waves; Reflection of ultrasonic waves; Refraction and mode conversion of ultrasonic waves; Straight beam, angle beam and surface beam transducers; Advantages of contact testing; Limitations of contact testing; The principal advantages of immersion testing; Limitations of immersion testing; Properties of a test specimen that will affect a particular ultrasonic test; Discontinuity conditions; General requirements for successful testing; Test interpretation; Calibration; Compression wave techniques; A-scan rectified and unrectified display; Lamination testing; Inspection of brazed and bonded joints; Shear wave techniques; Inspection of pipes; Surface wave techniques; Causes of material failures; Types of material failures; Procedure of examination; Duplex stainless steel; Inspection of welds; Shear wave root examination; Procedure for the shear wave root examination; Transducer characteristics; Characteristics of the beam of a circular transducer; Attenuation of sound waves; Acoustic impedance; Beam propagation; Ultrasonic testing techniques; Basic pulse-echo instrumentation (A-scan, B-scan, C-scan and Computerized systems); Digital thickness instrumentation; Resonance testing equipment ; Connecting cables Detailed knowledge of the different functions of UT test equipment; Sealing, insulation and flexibility; Couplants; Pulse-echo instrumentation; Calibration; Selection of technical parameters; Object appraisal; Variables affecting test results; Discontinuity variations; Procedure variations; Personnel variations; Detecting, locating (trigonometrical rules) and sizing techniques; Evaluation and confirmation of test reports; and Codes, standards specifications and procedures.

Ultrasonic Testing Techniques

Introduction, the propagation of low amplitude ultrasound, ultrasonic characterization, ultrasonic transducers, the principles of ultrasonic testing, ultrasonic testing equipment, ultrasonic flaw detection, flaw sizing in metals, the testing of metals, the examination of non-metals and adhesive bonds, training, certification and standards, laboratory experiments.

Web Management II

E-commerce principles. Management of a web environment.

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