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Student Handbook

Bachelor of Electrical and Electronics Engineering with Honours

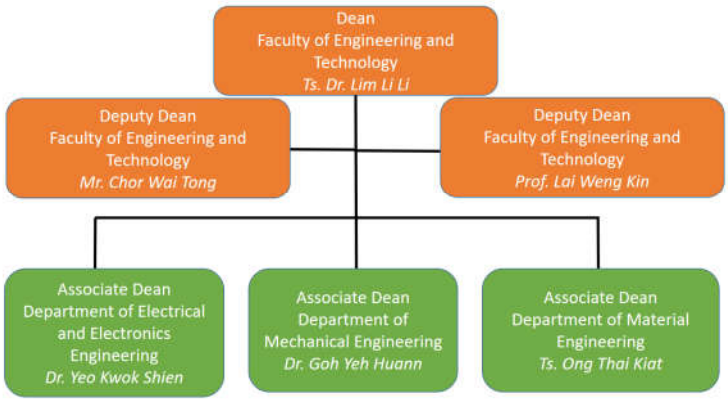
Compiled by:
Faculty of Engineering and Technology
Tunku Abdul Rahman University of Management and Technology,
Kuala Lumpur

General Information

1	**Background of Faculty of Engineering and Technology**

The Faculty of Engineering and Technology (FOET) began as the School of Technology (SOT) which was set up in 1972 to provide programmes which were designed and arranged such that students may sit for internationally recognised professional examinations or seek exemptions from such examinations, in particular the Board of Engineers Malaysia (BEM), and Engineering Council (EC), With the upgrading of Tunku Abdul Rahman College (TARC) to Tunku Abdul Rahman University College (TAR UC), the School of Technology (SOT) is now known as the Faculty of Engineering and Technology (FOET). However, our aim has always been to BUILD YOUR DREAMS AND ENGINEER YOUR FUTURE, ensuring your dreams fulfilled and your future secured.

2	**Organisation Chart**



3	**General Information**

3.1 Important Information on Notice Board and Intranet

Students must read the important announcements and information on the notice board placed outside the FOET, Student Intranet, and TARC UC website. Such announcements and information may include notices on time-table, deadline for online repeat registration, printing of bills & payment, loan application, deadline of printing and payment of tuition fees, interview session for unsatisfactory attendance, etc. The onus is on the students to read these important announcements and information regularly

3.2 Change of Address or Contact Number

It is the responsibility of the students to notify the office of the Faculty of any changes in their personal particulars, such as addresses or contact numbers so as to ensure their particulars in the Faculty database are accurate and up-to-date at all times. The Faculty will not be responsible or accountable for delayed, lost mail, or wrong information printed on official documents due to incorrect / obsolete students' addresses and contacts in the Faculty database. Application form for change of addresses or contact number can be obtained from the Faculty office. The completed form, duly filled in and signed, shall be submitted to the office of the Faculty whenever the changes occur.

3.3 Student Time Table

Students may download their time table from the Student Intranet at TARC UC website.

3.4 Tutorial Group

Each student will be assigned to a tutorial group. Exchange of tutorial groups will not be permitted except under exceptional circumstances for which prior approval in writing must be obtained from the Associate Dean of the Department. Closing date for submission of Application for Changing of Tutorial Group is normally at the end of second week after the commencement of each semester. Late application will not be entertained.

3.5 Attendance (Lectures, Tutorials and Practical)

Attendance for all lectures, tutorials and practical are compulsory. Students with unsatisfactory attendance will be barred from sitting the examination at the end of semester. Students who are barred from the examination will be required to repeat the barred course(s). Repeating barred course(s) includes re-attending lectures, tutorials and practical, re-submitting coursework, and re-sitting the written examination. In case of emergency or unforeseen circumstances, students shall apply for leave of absence for all lectures, tutorials and/or practical

3.6 Application for Leave of Absence

Application form for leave of absence may be obtained from the office of the Faculty. Application for leave of absence due to medical or compassionate reasons, must be duly filled in and signed, attached together with relevant supporting documents and submitted to the office of the Faculty within three (3) days from the date he/she resume his/her study. For other reasons, application for leave of absence, must be duly filled and signed, with a written explanation and/or supporting documents at least one (1) week before the date of absence.

3.7 Student Dialogue

The Faculty will conduct the Student Dialogue sessions with student representatives on programme matters twice in a 14-week semester, and once in a 7-week semester of each academic year.

3.8 Online Course Evaluation Survey

Towards the end of each semester, all students are required to complete the online course evaluation survey for all courses conducted.

3.9 Online Tracer Study

It is compulsory for all graduates to fill up the online tracer study as required by the Ministry of Education. For more information, please refer to Student Intranet at TAR UC website.

3.10 Student Attire

Students shall dress appropriately and conform to the following guidelines:

a) Within campus except games and co-curricular activities:

i. Collared shirts/T-shirt with sleeves and pants/jeans/skirt. No tattered attire is allowed, especially jeans.

ii. Shirts (except Hawaiian-style shirt) should be tucked in.

iii. Shorts are not allowed.

iv. Female students should dress appropriately and modestly. Mini skirts / dresses, high slits or low necklines, “bare back” apparel and exposed midriff and spaghetti-straps or see-through blouses are not allowed.

v. Proper footwear, shoes/sandals shall be worn. Japanese slippers are not allowed.

b) Laboratory Attire

i. Clothing that covers the upper body, arms, and entire leg to the ankle (e.g., pants, skirt, coveralls, lab coat) which fully protects exposed skin.

ii. Closed-toe shoes that resists rapid penetration by spilled liquids or sharps.

iii. In laboratories where a fire danger is present, avoid clothing made of synthetic fibres. Wear less flammable natural fibres, such as wool, cotton, jute, flax, and silk.

iv. Students must be equipped with appropriate personal protective equipment (PPE) relevant to each laboratory. It is the responsibility of the students to observe and abide by the rules and regulations related to laboratory operations.

c) For games and co-curricular activities:

i. Proper sports attire (T-shirt, short/track bottom and sports shoes) should be worn at all times.

4	Evaluation and Assessment

4.1 Assessment Components

Students shall be evaluated through the following components:

a) Final examination; and/or

b) Coursework which includes test, quiz, practical, project, report & case study; and/or

c) Any other evaluation approved by TAR UC.

4.2 Coursework Assessment

Coursework comprises of a combination of group and/or individual assignments, oral presentations, short tests, quizzes, laboratory experiment or practical reports, etc.

The pass marks for coursework is 50%. All students must pass the coursework, failing which the students are required to repeat the course concerned.

4.3 Plagiarism

The Faculty views the plagiarism or collusion cases very seriously. These include, but not limited to, plagiarism or collusion in any part of their assignments, projects or written work, threaten the values of academic work and undermine the credibility and integrity of TAR UC's awards. Plagiarism or collusion will be dealt with appropriately by the Faculty. Such offenders shall appear before a panel of enquiry at the Faculty and appropriate punishment will be meted out. Punishment may include failing the students' assignment or project, re-submission of another piece of work or downgrading of the work to the maximum of a pass grade.

Students are deemed to have signed a declaration that the work submitted, such as course work assignment, essays and projects, etc. is their own work and that they have not in any way knowingly allow another student to copy it. It will be assumed that all submitted work is that of the students' own work.

Students are expected to familiarise themselves with or make use of method(s) of citing other people's work in accordance with acceptable referencing. The referencing system used in FOET is the Harvard Referencing System.

4.4 Examinations

Refer to Intranet under Examination for Notices (e.g. registration for Resit/Repeat & co-curriculum); Information (e.g. examination regulation, awards, student discipline regulation) and other examination related matters.

4.5 Malaysian University English Test (MUET)

All Bachelor Degree students shall register and sit for MUET during the course of studying at TAR UC. They must achieve a minimum MUET score of Band 3 prior to their graduation. MUET comprises of Speaking, Listening, Reading and Writing components. This test is conducted three (3) times in a year. Students are advised to visit Majlis Peperiksaan Malaysia (MPM) portal at www.mpm.edu.my for detailed information, MUET centres and registration for MUET.

TAR UC's Centre for Continuing and Professional Education (CPE) will conduct the MUET preparatory course and MUET Seminar at prescribed fees for students. Students may contact CPE or refer to the TAR UC website for further information.

5 Computer Services and Facilities

CIT Centre is situated in Cyber Centre, a three-storey building with a total built-up area of 100,000 square feet. It is designed to provide an ideal environment for student learning and social educational interaction. Seventeen (17) ICT laboratories and twenty one (21) discussion rooms are fully equipped with Internet connectivity to support training, e-learning, multimedia language learning, and a host of other teaching and learning activities (such as Microsoft and SPSS software). These laboratories, discussion rooms and the spacious atrium are furnished and designed to provide a conducive learning environment for students with different learning styles and preferences. The technology supported teaching environment caters for different teaching approaches and knowledge acquisition. This building houses a fast, reliable and comprehensive network infrastructure and various supporting utilities to enable effective and efficient development, operation, and maintenance of ICT facilities and services provided to all campuses.

The functions and services provided by CIT Centre are:
a) Internet and Intranet Services
b) Network, Hardware and Software Services
c) Multimedia Services
d) Teaching and Learning Technology Support

6 Bursary

6.1 Payment of fees

Fees payable for newly register students must be paid before or on the date stipulated in the Letter of Offer.

Thereafter, fees payable at the beginning of each semester, unless otherwise specified, must be paid within two (2) weeks from the date of the commencement of the semester, failing which the students shall be withdrawn without further notification. For withdrawal due to non-payment of fees, the withdrawal date shall be the commencement date of the semester.

Payment of fees can be made through the following:
a) Any branches of Public Bank Berhad counters; or
b) Public Bank internet banking (www.pbebank.com); or
c) TAR UC Bursary Office (payment via Public Bank debit card, Public Bank credit card, bank draft, bank cheque (upon request), cash (upon request), money order or postal order only) in favour of “Kolej Universiti Tunku Abdul Rahman”.

Notwithstanding the above, if a student faces financial problem and is unable to pay the tuition fees on time, they may be allowed to extend the payment of fees or pay by installment provided that the student has submitted a written explanation, a copy of student bill, and supporting documents to the office of the Faculty before the stipulated deadline stated in the Student Bills.

In the instance where the student is a Perbadanan Tabung Pendidikan Tinggi National (PTPTN) loan holder, and that there is a non-payment of tuition fees due to delay in banking of the loan into the student’s account. The student must submit a completed Application Form for Extension of Payment to the Faculty office.

Payment after the due date of payment of fee shall be made via Public Bank debit card or in the form of bank draft only. A bank draft is not a receipt of payment made, it is a cash cheque purchased from the bank. The original bank draft should then be submitted to Bursary for payment.

6.2 Online Printing of Semester Tuition fees

Students will be advised on the fees payable via notices displayed on the Faculty notice boards or TAR UC website. Students shall print two (2) copies of the Student Bills via Student Intranet one (1) week before commencement of each semester. The onus is on the students to print the Student Bills and pay the fees before or by the stipulated deadline stated in the Student Bills, failing which it is deemed that the students would have withdrawn from TAR UC. No late printing of bills will be entertained.

6.3 Refund of fees

All fees paid are strictly non-refundable and non-transferable.

However, there is a Refund of Fees for newly registered students who withdraw if notification of withdrawal in writing is received before the commencement date of the programme. Fifty percent (50%) of the amount of Tuition Fee, Special Administration Fee, Examination Fee, Laboratory/Workshop Fee and Facilities & Resource Fee paid by the student may be refunded. Registration, Orientation and Activity Fees are strictly non-refundable. If notification of withdrawal in writing is received after the commencement date of the programme, there is strictly no refund of all fees paid. This applies to students who pay and register after commencement date of the programme upon withdrawal from the programme.

Caution money (less any liabilities) may only be refunded on application after a student has completed or withdrawn from his/her last programme of study at TAR UC. The application for the refund shall be made within one (1) year from the date of completion of study or withdrawal from TAR UC, failing which the said caution money shall be deemed as donation to the Student Loan Fund.

6.4 Fees for Resit Examination and Repeating Courses

Upon online registration for Resit and/or Repeat course(s), students shall print two (2) copies of the bills via Student Intranet. The onus is on the students to print the Resit and/or Repeat bills and pay the fees before or by the stipulated deadline stated in the Resit and/or Repeat bills. As a guide, payment of resit and repeat bills shall be made by week 5 of the 14 lecture-week semesters or by week 3 of 7 the lecture-week semester.

No late Printing of Bills and Payment of Fees will be entertained. The Resit and/or Repeat fees will not be refunded even if the student is absent from the examination.

6.5 Facilities & Resources Fee

A relatively small amount of facilities & resources fees per student per academic year are charged to help the University to defray the large amount of annual expenditure incurred to provide well-equipped laboratories/workshops/facilities for students' learning. The commitment of these fixed expenses (e.g., licensing fees) are irrespective of the usage.
Refer here for definitions of other fees:

https://www.tarc.edu.my/bursary/fees-glossary/

7 Financial Aid

There are various types of loans available for all students to apply. The loans are meant to assist students who face financial difficulties in completing their studies in TAR UC.

7.1

a) TAR UC Merit Scholarship (No application is required, scholarship will be awarded automatically)
b) The Star Education Fund Scholarship
c) Nanyang Tertiary Education Fund Scholarship
d) Sin Chew Daily Education Fund Scholarship
e) TAR UC for State/National Players
f) Tan Sri Lee Loy Seng Foundation Scholarship
g) S.P.Setia Foundation Scholarship
h) Grants and awards by generous individuals
i) Industry-Based Study Grants

7.2 Student Loans

There are various types of loans available for students to apply. The type of loans available are as follows:

a) TARC Student Loan Fund (Open for application in weeks 1-3 of May and September yearly)
b) Perbadanan Tabung Pendidikan Tinggi National (PTPTN) Loan
c) Penang State Loan
d) Perak State Loan
e) Selangor State Loan
f) Chang Ming Thien Foundation Loan
g) KOJADI Study Loan
h) Carlsberg Hua Zong Education Fund Loan

Please visit the website of TAR UC or contact Department of Student Affairs (DSA) for more information about scholarships and financial assistance.

8 Library

The Library aims to provide library resources and services to support the teaching, learning and research needs of TAR UC.

8.1 Academic Resources

The Library has a total collection of over 220,000 volumes of printed books, over 300 titles of print + online serials and 10,600 units of electronic/audio-visual materials. It also provides access to an extensive range of remotely accessible online resources; local and international databases, electronic journals, e-books and CCH online publications.

Databases subscribed by the Library include ACM Digital Library, Ebrary, EBSCOhost Business Source Complete, Emerald, IOPScience, LawNet, Passport GMID, ProQuest Research Library and ProQuest Science Journals.

8.2 Facilities and Services

The Library caters for individual and collaborative work, with over 2,200 seats. Students have access to outstanding facilities for their academic work and study that include study carrels, individual study rooms, discussion rooms, reading rooms, audio visual room, Internet PCs, Wi-Fi access and many more.

The Library provides a number of services including loan services, reference services, self-service borrowing, user education programmes, interlibrary loan services, photocopying services, etc. Registered faculty, staff and students can search the library holdings, gain direct access to the full-text of electronic database and renew/reserve items at anytime, anywhere via Web OPAC (InfoWeb-Online Catalogue).

9	**Student Services**

9.1 Accomodations

Information on rooms available is regularly disseminated on notice boards maintained by DSA.

TAR UC campus hostel accommodation is available and situated on a 6-acre land. It consists of 10 blocks of 5-storey building with 1,000 rooms which can accommodate 2,000 students. Hostel availability is based on first-come-first-served basis. Students may apply for the hostel only after receiving TAR UC Offer Letter and having paid the full fees. Please visit the website of TAR UC or contact DSA for more information about hostel accommodation.

Other than UC campus hostel, TAR UC students are able to find accommodation in the nearby housing estates which are within easy reach of TAR UC campus, such as:

• Taman Bunga Raya • Jalan Genting Kelang • Taman Desa Setapak • Taman Sri Rampai
• Wangsa Maju • Setapak Jaya • Taman Melawati • Setapak Indah • Taman Melati
• Taman Danau Kota • Wangsa Melawati

Students shall sign a tenancy-agreement with the landlord. It is important that the terms and conditions of the agreement should be clearly stipulated so as to avoid any misunderstanding. Copies of information sheets, "Guidelines on Tenancy Agreements" and "Sample of Tenancy Agreement" are available at the DSA upon request.

9.2 TAR UC Campus Hostel Accommodation

TAR UC campus hostel accommodation is available and situated on a 6-acre land. It consists of 10 blocks of 5-storey building with 1,000 rooms which can accommodate 2,000 students. Hostel availability is based on first-come-first-served basis. Students may apply for the hostel only after receiving TAR UC Offer Letter and having paid the full fees. Please visit the website of TAR UC or contact DSA for more information about hostel accommodation.

9.3 Sport and Recreation

The outdoor sports facilities available are:

a) One sports field comprising one soccer pitch, jogging track and two netball courts
b) One futsal court
c) One handball court
d) One dodgeball court
e) Two volleyball courts
f) Three basketball courts

9.5 Students' Insurance Scheme

A 'Student Personal Accident Insurance Scheme' insures all students of TAR UC. The policy will cover the students for accidents round the clock, anywhere in the world. The sum insured is RM60,000 for death or total disablement. In the event of death of the policy holder, funeral expenses not exceeding RM5,000 would also be paid.

In addition, students can also claim for medical treatment up to a maximum of RM5,000 and/or RM500 for traditional treatment per year (registered medical practitioners only) for injuries sustained in an accident. Copies of the Insurance Policy's terms and conditions are available at the DSA for reference.

9.6 Student Counseling Services

A team of counselors is available to help students with emotional, personal or academic concerns through individual counseling sessions, group counseling sessions, workshops and seminars. The counselling services are strictly confidential. All individual and group counselling services are free of charge. Counselling services are available to students during office hours at the DSA.

9.7 Student Development and Career Services

Student Development and Career Services (SDCS) offers uniquely designed life programmes that are central to a student's personal and career growth. Some of SDCS specially crafted programmes are:

a) "Your Leadership DNA" gives students the tools necessary to attain true leadership quality.
b) "The Road to Excellence" has been designed to enhance students' resiliency and learning agility.
c) ENACTUS TAR-UC provides students a very unique platform to develop themselves by helping the communities that are in need.
d) Career Development Workshops & Talks throughout the semester to help students to be aware of present day industries' requirements. The career development workshops are conducted by counsellors, recruitment firms and professional organizations who would guide students in the identification of skills, interests, values and how to make appropriate career decisions with confidence and maximise their employability opportunities.

Some of the Career Talks or Workshops are:
- Company Talks
- Creating Your Future Workshop
- Personality, Goal Setting & Career Profiling Workshops
- Resume Writing & Interviewing Skills Workshops
- Leadership Camp
- Career Decision Making
- Career Fairs

9.8 Clubs, Societies and Committees

It is compulsory for students to join and participate in student academic society of the programme of study.

Advisors and Assistant Advisors will be appointed to guide and advise the students in the societies' activities.

Notwithstanding the above, students are strongly encouraged to join and participate in other clubs and committees for their personal development. Please refer to TAR UC website (www.tarc.edu.my) for a complete list of clubs, societies and committees.

9.9 Study Abroad Unit (SAU)

The University College has entered into various progression and articulation arrangements with universities overseas for both undergraduate and postgraduate studies. SAU provides you with useful information and the academic counselling to ensure you get the best out of your plans to study abroad. For further enquiries, students may visit the Study Abroad Unit (SAU) located at the Centre for Continuing and Professional Education (CPE Centre).

10	Scheduled Classes

Scheduled classes are indicated in the students' timetable available in Student Intranet. Classes can be arranged from MON-SAT, and being conducted face-to-face, in Blended Learning (BL) or online learning mode depending on the nature of the course registered. Students are required to fulfil stipulated class attendance requirement as specified in Student Attendance Guidelines.

11	Miscellaneous

Students must note that upon registering as students of TAR UC through payment of fees, they are to abide and comply with all the student code of conduct, rules and regulations of TAR UC. These include payment of fees, attendance of classes, examinations, and comply with all rules. It is the responsibility of students to familiarise themselves with this code of conduct, rules and regulations. Any breach of the same may lead to disciplinary action.

12	Credit Transfer

A new student may apply for programme transfer at the beginning of the programme within the stipulated deadline. Applications for intra-faculty transfers (i.e. programme transfers within the faculty should be submitted to the FOCS Office (A215) whereas applications for inter-faculty transfers (i.e. programme transfers to other faculties) should be submitted to the Department of Admissions & Credit Evaluation (Ground Floor, Bangunan Tun Tan Siew Sin) within the stipulated deadline. The closing date for programme/campus transfer is normally on the second Friday after commencement of lectures.

Approval for the programme/ campus transfer is not guaranteed. Students whose transfers are successful are required to collect their transfer offer letter from FOCS Office (for Intra-Faculty Transfer) or Department of Admissions & Credit Evaluation (for Inter-Faculty Transfer/Campus Transfer). Students who have accepted the programme/campus transfer will NOT be allowed to transfer back into their original programme/campus of study after accepting the transfer through the payment of fees.

13	REINSTATEMENT, DEFERMENT AND WITHDRAWAL OF STUDIES

Students may find the information for reinstatement, deferment and withdrawal of studies from TAR UMT website at https://www.tarc.edu.my/admissions/new-student/general-information/.

Ex-TARCians who had withdrawn from their Bachelor Degree/Diploma programme and have enrolled into another programme of the same level may be eligible for horizontal credit transfer. The application for horizontal credit transfer is to be made at the respective Faculty latest by Friday of week 4 (for long semester) or week 3 (for short semester) after the commencement of the semester first joined.
The application and more information is available at https://www.tarc.edu.my/files/admissions/form/AE48885A-7057-47AA-9A92-88142B8C6E44.pdf

Programme Outcomes Mapping

1 Introduction

Electrical and Electronic Engineering shows you how a touchscreen responds to your fingers, how your GPS knows exactly where you are and how electricity arrives at your doorstep with a flick of a switch from a power plant hundreds of kilometres away. Electrical and Electronic devices are everywhere, rapidly changing the way we live our lives. It is the leading sector in Malaysia's industry. The programme will prepare you to be a competent engineer well equipped to meet the challenges of a very fast-moving industry. The emphasis of the programme is on sustainable design, development and commercialisation of a wide range of electrical & electronic products and services. This includes consumer electronics, intelligent control systems, electrical energy, power systems and electrical machines.

2 Programme Educational Objectives (PEO)

PEO1	Graduates are competent in the practice of Electrical and Electronics engineering.
PEO2	Graduates are engaged in lifelong learning and professional development
PEO3	Graduates are committed to professionalism in engineering practices and contribute to the society.

3 Programme Outcomes (PO)

PO1	Engineering Knowledge - Ability to acquire and apply knowledge of electrical and electronic engineering to the solution of complex engineering problems
PO2	Problem Analysis - Ability to perform complex electrical and electronic engineering problem analysis through identification, formulation, research and critical analysis through systematic approach.
PO3	Design/Development of Solutions - Ability to utilise systems approach to evaluate performance and design solutions for complex problems in electrical and electronic engineering systems.
PO4	Investigation - Acquire in-depth technical competence to conduct investigation into complex electrical and electronic engineering problems using research-based knowledge and research methods to obtain valid
PO5	Modern Tool Usage - Ability to create, select and apply modern tools, appropriate techniques and resources to complex electrical and electronic engineering problems, with an understanding of the limitations.
PO6	The Engineer and Society - Understand the social, cultural, global and environmental responsibilities of a professional electrical and electronic engineer's practice and solutions to complex engineering problems.
PO7	Environment and Sustainability - Understand the needs and principles of sustainable development and the social/environmental impact of solutions to complex electrical and electronic engineering problems.
PO8	Ethics - Understand the professional and ethical responsibilities of electrical and electronic engineers and the commitment to them.
PO9	Communication - Ability to communicate effectively on complex electrical and electronic engineering activities in both oral and written means with people of technical and non-technical background.
PO10	Individual and Team Work - Able to function effectively as an individual and in a group with the capacity to be a leader or manager.
PO11	Life Long Learning - Recognise that engineering is a fast-evolving field requiring the need for life-long learning and possessing/acquiring the capacity to do so.
PO12	Project Management and Finance - Understand project management principles and issues that are required to deliver successful engineering projects in multidisciplinary environment.

4	PO - PEO Mapping		
	PEO1	PEO2	PEO3
PO1	✓		
PO2	✓		
PO3	✓		
PO4	✓		
PO5	✓		
PO6			✓
PO7			✓
PO8			✓
PO9	✓		
PO10	✓		
PO11		✓	
PO12	✓		

TARUMT
TUNKU ABDUL RAHMAN UNIVERSITY OF MANAGEMENT AND TECHNOLOGY

GENERAL GUIDELINES FOR THE USE OF GENERATIVE ARTIFICIAL INTELLIGENT (AI) TOOLS IN TEACHING, LEARNING, AND ASSESSMENT (TLA)

WHAT IS GENERATIVE ARTIFICIAL INTELLIGENT (AI) TOOLS

Generative artificial intelligence (AI) describes algorithms (such as ChatGPT) that can be used to create new content, including audio, code, images, text, simulations, and videos.

HOW IT WORKS

Generative AI tools may be used to generate preliminary ideas, refine writing skills and enhance comprehension or writing techniques of any subject matter within the context of the given academic tasks.

BE POSITIVE

- Lecturers are to remain positive about generative AI tools and their educational potential.
- Do NOT limit any students' access to generative AI tools or any form of technology that could be beneficial to their learning experience.
- Lecturers shall educate and support students to use the generative AI tools ethically and responsibly.

BE CREATIVE

- Lecturers shall intensify efforts by focusing more on experiential learning and encourage students to demonstrate their learning by means of interpreting, live demonstration, analysing, peer discussions, synthesising the relevant information and other interactive methods which develop students' critical thinking and problem-solving skills.
- Lecturers shall redesign the assessment criteria that required more oral assessment, critical thinking and problem-solving skills, open-ended questions, real case study or set milestones for the research project and provide feedback for each milestone to understand students' progress and prevent them from using Generative AI excessively.

BE RESPONSIBLE

- Coursework assessments that allow excessive use of Generative AI tools shall be avoided.
- All staff and students shall strive to uphold academic integrity and adhere strictly to the University's plagiarism policy which is made available on the intranet.
- The university takes plagiarism and other breaches of academic integrity including violation of intellectual property and copyright laws, deceptive fabrication and all other forms of cheating seriously.
- All academic works submitted for assessment purposes must be original and students must not submit any academic work that merely presents ideas or arguments solely derived from any generative AI tools or other sources without proper acknowledgement.
- Any suspected plagiarism and use of generative AI tools without acknowledgement during the grading of assessments will be treated as academic misconduct and is subject to disciplinary action by the University.
- Students are required to acknowledge the originality of their works and use of generative AI tools by signing a plagiarism statement form.

Course List

Course Number	Course Code and Title
1	MPU-31T3 PENGHAYATAN ETIKA DAN PERADABAN
2	BTEH1013 BASIC ELECTRONICS
3	BTMR1313 ELECTRIC CIRCUITS
4	BTGE1013 ENGINEERING MATHEMATICS
5	BTEH1213 DIGITAL LOGIC DESIGN
6	BTEH1713 ENGINEERING DRAWING AND CADD
7	BJEL1513 ENGLISH FOR TERTIARY STUDIES
8	BTEH1023 ANALOGUE ELECTRONICS
9	BTGE1023 APPLIED ENGINEERING MATHEMATICS
10	BTEH1223 MICROPROCESSOR SYSTEMS
11	BTEE1513 ELECTRICAL TECHNOLOGY
12	BTGE1043 PROGRAMMING FOR ENGINEERS
13	BJEL1523 ACADEMIC ENGLISH
14	BGGE2044 PROJECT MANAGEMENT AND FINANCE
15	BTGE2013 ADVANCED ENGINEERING MATHEMATICS
16	BTEE2013 ANALOGUE SYSTEM DESIGN
17	BTEC2313 CIRCUITS ANALYSIS
18	BGEE3513 ELECTRICAL MACHINES
19	COCU COCURRICULAR ACTIVITIES
20	BTEC2233 DIGITAL SYSTEM DESIGN
21	BTGE2023 FURTHER ENGINEERING MATHEMATICS
22	BGEE2614 ELECTRICAL POWER SYSTEMS
23	BTEC2714 ELECTROMAGNETIC FIELDS
24	BJEL2913 ENGLISH FOR CAREER PREPARATION
25	BGEE3804_1 CAPSTONE PROJECT
26	MPU-3252 ENTREPRENEURSHIP
27	BTGE3413 CONTROL SYSTEMS ENGINEERING
28	BGEC3314 DIGITAL SIGNAL PROCESSING
29	BTEE3513 POWER ELECTRONICS AND DRIVES
30	BGGE3713 ENGINEER AND SOCIETY
31	BGEE3804_2 CAPSTONE PROJECT
32	BTEE3623 POWER SYSTEM ANALYSIS
33	BTEE3633 ELECTRICAL ENERGY UTILISATION
34	BTEE3013 COMMUNICATION SYSTEMS PRINCIPLES
35	BTEH4413 ARTIFICIAL INTELLIGENCE
36	BTEE3905 INDUSTRIAL TRAINING
37	BGEE4022 PROJECT I
38	BGEE4183 DATA ENGINEERING AND ANALYTICS
39	BGEE4723 RENEWABLE ENERGY
40	BGEE4044 PROJECT II
41	MPU-31E3 FALSAFAH DAN ISU SEMASA
42	BTMR3423 DESIGN OF CONTROL SYSTEMS
43	BTEE3213 COMPUTER ARCHITECTURE
44	BTEE4013 MICROELECTRONICS
45	BTEE4623 HIGH VOLTAGE ENGINEERING
46	BTEC4213 EMBEDDED SYSTEMS
47	BTEE4613 POWER TRANSMISSION AND DISTRIBUTION
48	BGEE4223 COMPUTER VISION

49 BTEC4313 MULTIMEDIA TECHNOLOGY AND APPLICATIONS
50 BTEE4633 POWER SYSTEM PROTECTION
51 BTEE4033 INTEGRATED CIRCUITS TECHNOLOGY
52 BTEE4643 POWER QUALITY

1.	Name of Course :	PENGHAYATAN ETIKA DAN PERADABAN
	Course Code :	MPU-31T3
2.	Synopsis :	Kursus ini menjelaskan tentang konsep etika daripada perspektif peradaban yang berbeza bagi mengenal pasti sistem, tahap perkembangan, kemajuan dan kebudayaan merentas bangsa dalam mengukuhkan kesepaduan sosial menurut acuan Malaysia. Selain itu, perbincangan juga berkaitan isu-isu kontemporari dalam aspek ekonomi, politik, sosial, budaya dan alam sekitar daripada perspektif etika dan peradaban yang dapat melahirkan pelajar yang bermoral dan profesional.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Menjustifikasikan Isu Etika Dan Peradaban Dalam Acuan Malaysia Berdasarkan Senario Semasa. (A3, PLO9)
	CLO2	Menghubungkaitkan Konsep Etika dan Peradaban dalam Kehidupan Seharian. (A4, PLO9)
	CLO3	Menganalisis Peranan Etika dan Peradaban dalam Kajian Kes Tempatan dan Antarabangsa. (A4, PLO11)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1									✓					
CLO 2									✓					
CLO 3											✓			

7 **Course Content Outline**

Bab 1: Pengenalan Ilmu Ketamadunan
- Definisi Ilmu Ketamadunan
- Konsep Tamadun
- Hubungan Ilmu Ketamadunan dan Sejarah Tamadun
- Hubungan antara Tamadun, Agama, Bangsa dan Budaya
- Pemikiran Ibnu Khaldun

Bab 2 Konsep Etika & Peradaban
- Konsep Etika
- Perspektif Agama & Kepercayaan – Hindu, Buddha, Islam, Kolonial & PascaKolonial
- Konsep Peradaban – Kolonial &

Bab 3 Etika & Peradaban dalam Masyarakat Kepelbagaian
- Petempatan Masyarakat
- Garis Masa Pembentukan Masyarakat Malaysia

Bab 4 Pemantapan Kesepaduan Nasional Malaysia
- Perpaduan: Matlamat Diidamkan

Bab 5 Pembinaan Peradaban Majmuk Di Malaysia
- Perkembangan Sejarah Peradaban Di Alam Melayu

Bab 6 Perlembagaan Persekutuan – Tapak Integrasi, Wahana Etika & Peradaban
- Definisi & Konsep Tapak Integrasi
- Definisi & Konsep Perlembagaan
- Sejarah & Latar Belakang Perlembagaan

	Bab 7 Teknologi Maklumat & Komunikasi Penggerak Kesepaduan Nasional Di Malaysia • Evolusi & Pengglobalan Teknologi • Evolusi Teknologi & ICT Di Malaysia • Konsep Hubungan Manusia & Teknologi • Etika & Peradaban Dalam Penggunaan ICT • ICT Tapak Pengukuhan Kesepaduan	
	Bab 8 Peranan Etika & Peradaban Mendokong Tanggungjawab Sosial Di Malaysia • Konsep Takrifan Harian & Autoriti • Fungsi Etika & Peradaban Dalam Membentuk Tanggungjawab Sosial • Kesedaran Nasional Dalam	
	Bab 9 Cabaran Kelestarian Etika & Peradaban Di Malaysia • Kelestarian Etika & Peradaban Malaysia • Kedinamikan Etika & Peradaban Malaysia • Hakisan Sosial Ke Atas Kelestarian Etika & Peradaban • Kelangsungan Kelestarian Etika &	
8	References (include required and further readings, and should be the most current)	1. Ateerah Abdul Razak, Nur Azuki Yusuff, Zaleha Embong, 2021, Penghayatan Etika dan Peradaban, UMK, Bachok, Kelantan. 2. Ahmad Zamil Abdul Khalid (et al), 2021, Penghayatan Etika dan Peradaban, UUM Press, Sintok, Kedah.

1.	Name of Course :	BASIC ELECTRONICS
	Course Code :	BTEH1013
2.	Synopsis :	Basic Electronics provides the fundamental knowledge in the semiconductor theory which forms the building block of all electronic devices.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	analyze electronic circuits containing diodes. (C3)
	CLO2	analyze single-stage transistor-based amplifiers. (C3)
	CLO3	implement diode/transistor based circuit from system specification to final presentation in practical teams using computer aided analysis tool(P3)
	CLO4	analyze simple digital logic gates. (C3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3					✓									
CLO 4		✓												

7 **Course Content Outline**

Semiconductor and PN Junctions
- Concepts of insulators, conductors, semiconductor materials.
- Atoms, Covalent bonds, conduction in semiconductor crystals, N-type and P-type semiconductor.
- PN junction, biasing the PN junction.

Diodes and applications:
- Diode characteristics.
- Operation of diodes, ideal and practical diode models.
- rectification: half-wave, full-wave, power supply and regulator
- waveform shaping: limiter, clamper, voltage multiplier.

Special Purpose Diodes
- Zener Diode characteristics and applications: voltage stabilization and surge protection
- Varactor diode, optical diodes, PIN, Schottky diodes etc.

Bipolar Junction Transistor
- Structure and operation (npn, pnp).
- Parameters and characteristics.
- Transistor as a voltage amplifier and a switch.
- Transistor biasing: the DC operating point, base bias, emitter bias, voltage-divider bias.
- Small signal Transistor amplifier: linear operating region, Common-emitter, Common-collector and Common-base amplifiers; AC equivalent circuits based on r-parameters and h-parameters.
- Multi-stage amplifiers.

Digital Logic Circuits
- Diode-Resistor Logic (DRL)
- Resistor-Transistor Logic (RTL)
- Diode-Transistor Logic (DTL)

8	References (include required and further readings, and should be the most current)	Main 1.Thomas L Floyd, 2018. Electronic devices: conventional current version, 10th Edition, Pearson Prentice Hall. 2.Alexander Axelevitch, 2019. Digital Electronic Circuits - The Comprehensive View, World Scientific. Additional 1. Robert L. Boylestad; Louis Nashelsky, 2013. Electronic Devices and Circuit Theory, 11th Edition, Pearson.

1.	Name of Course :	ELECTRIC CIRCUITS
	Course Code :	BTMR1313
2.	Synopsis :	Electric Circuits aims to equip students with a strong foundation in circuit analysis using various electrical circuit theorems, which are essential for further studies in electronic engineering and related fields.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	demonstrate understanding of basic electrical principles for resistive circuit measurements. (C3)
	CLO2	use suitable circuit theorem to solve DC circuit problems. (C3)
	CLO3	apply basic electrical principles for inductive or capacitive circuit measurements. (C3)
	CLO4	use electronic workbench tools in circuit analysis (P3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3		✓												
CLO 4					✓									

7 **Course Content Outline**

Basic Electrical Systems
- Electromotive Force and potential difference
- Atomic structures
- Charge and Current
- Current flow convention
- Ideal and practical voltage and current source

Ohm's Law:
- Ohm's Law and resistance
- The relationship of current voltage and resistance
- Insulators and conductors
- Electrical safety

DC Series Circuit
- Resistors in series
- Current in an electric circuit
- Total series resistance,
- Ohm's law in series circuit
- Voltage sources in series
- Kirchhoff's voltage law

DC Parallel Circuit
- Resistors in parallel
- Voltage in parallel circuits
- Kirchhoff's current law
- Total parallel resistance
- Ohm's law in parallel circuits

Circuit Theorems and Conversions
- The voltage source
- The current source
- Source conversions
- The superposition theorem
- Thevenin's theorem

	Branch, Mesh and Node Analysis • Branch current method	
	Basic Instrumentation • Principles and application of electronic voltage meters • Moving- coil instrument	
	Introduction to Alternating current and voltage • Generation of alternating e.m.f. • Sinusoidal voltage sources • Voltage and current values of sine waves • Angular measurement of a sine wave • The sine wave formula • Average and effective values • Form factor	
	Electromagnetism and Inductors • The magnetic field • Electromagnetism • Field strength	
	Capacitors • The basic capacitor • Types of capacitors • Series capacitors • Parallel capacitors • Capacitors in DC circuits • Capacitors in AC circuits Inductors	
	AC Circuits • Response of basic R, L, C element to a sinusoidal voltage or current • Inductive and capacitive reactances, impedance, admittance, conductance, susceptance • Leading and lagging of current in R, L, C elements • Frequency response plots of the L and C elements. • Phasor representation of voltage and current in AC circuits. • Voltage and current in parallel RL and RC circuits. • Expressing voltage, current and impedance in complex notation, rectangular form and polar form. • Power in AC circuit	
8	References (include required and further readings, and should be the most current)	1. Thomas L. Floyd, David M. Buchla, Principles of Electric Circuits: Conventional Current Version,10th edition, Pearson (2020) 2. Charles Alexander and Matthew Sadiku, Fundamentals of Electric Circuits, 7th Edition, Mc Graw Hill (2021) 3. Robert L. Boylestad, Brian A. Olivari, Introductory Circuit Analysis, 14th Edition, Global Edition, Pearson (2023)

1.	Name of Course :	ENGINEERING MATHEMATICS
	Course Code :	BTGE1013
2.	Synopsis :	A sound knowledge of mathematics is critical for engineers to define and resolve the parameters of the models mapping the engineering processes and problems. This course provides students the fundamentals of mathematical techniques for applications used in engineering.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Solve engineering problems involving matrices. (C3)
	CLO2	Apply vector algebra to solve engineering problems. (C3)
	CLO3	Solve engineering problems involving complex numbers. (C3)
	CLO4	Apply the concept of discrete mathematics and statistics to solve engineering problems. (C3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2	✓													
CLO 3	✓													
CLO 4	✓													

7

Course Content Outline

Matrix:
- Introduction to Matrix
- Basic Operation and properties of matrix
- Transpose and skew matrix
- Determinant of Matrix
- Inverse of Matrix
- Cramer rules
- Gaussian Elimination

Vector :
- Introduction to vector
- Vector operation
- Equation of line
- Dot product
- Projection of vector
- Equation of plane

Complex numbers
- Operation of complex numbers
- Modulus, argument, Polar form of complex numbers
- Euler formula
- De Moivre's Theorem
- Complex roots in conjugate

Discrete Mathematics:
- Logic

	Statistics: • Frequency distribution, Histogram, Frequency polygon, Cumulative Frequency Polygon- Ogive, Quartile, Deciles and Percentiles • Measures of Central Tendency: Mean, Median, Mode • Measures of Dispersion: Variance, Standard Deviation, Interquartile Range Probability: • Rules of probability • Binomial Distribution • Poisson Distribution • Normal Distribution	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Yang, X.S., (2017) Engineering Mathematics with Examples and Applications, Elsevier. 2. Croft, A. et. al. (2017) Engineering Mathematics: A foundation for electronic, electrical, communications and systems engineers, Pearson. 3. Glyn James et al. (2020). Modern Engineering Mathematics. 6th Edition. Pearson. Additional references supporting the course 1. Stroud K.A., Booth D.J. 2013. Engineering Mathematics. 7th Edition. Palgrave MacMillan. 2. O'Neil P.V. 2012. Advanced Engineering Mathematics. 7th Edition. Cengage. 3. Washington A.J. 2014. Basic Technical Mathematics with Calculus. 10th Edition. Pearson.

1.	Name of Course :	DIGITAL LOGIC DESIGN
	Course Code :	BTEH1213
2.	Synopsis :	Digital logic design forms the foundation of electronics engineering and computer engineering. This course will equip students with basic knowledge to develop digital hardware in both combinational and sequential logic circuits.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	construct combinational logic circuits using discrete logic gates and simple MSI & LSI components (C3)
	CLO2	construct synchronous and asynchronous sequential circuits (C3)
	CLO3	demonstrate understanding of digital memory and PLD in digital logic circuit (C3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2			✓											
CLO 3	✓													

7 **Course Content Outline**

Digital Logic and Technology:
-The history of digital logic, digital circuit manufacturing: IC packaging, IC identification.
Numbering Systems:
-Binary, Octal, Decimal, Hexadecimal-Number base conversions, complements, signed Binary numbers.
-Binary Arithmetic, Binary codes: Weighted-BCD-2421-5421-Gray code-Excess-3 code, ASCII conversion from one code to another.

Boolean algebra:
-Boolean logic operations, DeMorgan's Theorem, Logic gates AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR.
-Truth tables. Examples of logic gate devices and families. Data sheets.

Designing combinational circuits:
-Relating Boolean expressions to truth tables, SOP, POS logic representation. Logic minimisation using Boolean algebra and Karnaugh maps (Max. 4 variables), equivalent logic representation.

Designing MSI circuit
-Multiplexers: internal architecture, design and simple application.
Design procedures:
-Problems specification relating to truth table. Encoders, code converters, and case studies. Combinational logic circuit verification and test.

Sequential Circuits:
Flip-Flop:
-RS, JK, T, D flip-flops, clocked flip-flops, flip-flop integrated circuit features, flip-flop operation, transfer operation, shifting operation, counting operation, analysis of flip-flop circuits, timing diagrams.
Other Sequential Circuits:
-Shift registers, serial and parallel data transfer.
-Counting circuits: Synchronous, asynchronous, binary 8421, decade, MOD-N, up-, down-, up/down, maximum counting frequency.
-Function of Clocking circuits.
Design of synchronous counters:
-State diagram
-State table, State assignment, Excitation table and maps, Circuit implementation.

	Introduction to digital system: -Elements of a digital system. -Example of digital systems: Calculators, Computers, data transmission systems, PLC, Microcontrollers. -Memory sub-systems, CPU memory connections. -ROM architecture, read/write timing, Applications, Flash memory. -RAM architecture, static RAM cell, read/write timing, expanding word size and capacity, incomplete address decoding. -Introduction to DRAM, characteristics and Technology.	
	Introduction to Programmable Logic Devices (PLD): -Introduction to EPROM, EEPROM	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Ronald J. Tocci, Neal S. Widmer, Gregory, Digital Systems: Principles and Applications, 12th Edition, Prentice Hall (2017). 2. Roth Jr, C.H., Kinney, L.L. and John, E.B., Fundamentals of logic design. 7th Edition. Cengage Learning (2020). Additional references supporting the course 1. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Prentice Hall (2015). 2. Tokheim, R.L., Hoppe, P.E. Digital Electronics: Principles and Applications. 9th Edition McGraw-Hill (2022).

1.	Name of Course :	ENGINEERING DRAWING AND CADD
	Course Code :	BTEH1713
2.	Synopsis :	This course covers the activities that equip students with the ability to visualize objects in three dimensions and to present engineering information in a pictorial or graphical manner, and to extract information from such drawings. Besides learning the traditional method using the drawing board and T-square, students will also be exposed to computer-aided drafting and design.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Produce technical drawings of engineering components according to B.S.8888:2008 using manual drawing techniques. (P2)
	CLO2	Produce technical drawings of engineering components according to industrial standards using computer-aided draughting techniques. (P2)
	CLO3	Produce technical drawings of electronic circuits according to industrial standards using computer-aided draughting techniques. (P2)
	CLO4	Prepare complete working drawings by utilising and interpreting given technical information. (C3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2					✓									
CLO 3					✓									
CLO 4	✓													

7

Course Content Outline

SECTION A: Engineering Drawing

Introduction to engineering drawing;
Lettering, line work, reduced and enlarged scale;
Geometrical Constructions;
Defining and drawing lines and curves, standard regular shapes and parametric modelling;
Dimensioning and essentials of B.S.8888:2008;

SECTION B: AutoCAD

Computer Aided Design;
Organisation of the AutoCAD screen;
Types of coordinate entries (absolute, relative and polar);

SECTION C: PCB Design CAD Tool

SECTION A : Engineering Drawing

Orthographic Projection (first and third angle);

SECTION B: AutoCAD

Using draw/modify toolbar;
Creating and editing of points, lines, circles and arcs;

SECTION C: PCB Design CAD Tool

SECTION A : Engineering Drawing

Isometric and oblique projection;
Development of full and truncated shapes of surfaces of regular objects, pipe joints and other joints

	SECTION B: AutoCAD Using draw/modify toolbar; Creating and editing of points, lines, circles and arcs;	
	SECTION C: PCB Design CAD Tool	
	SECTION A : Engineering Drawing Internal and external screw threads;	
	SECTION B: AutoCAD	
	SECTION C: PCB Manufacturing	
	SECTION B: AutoCAD 3D – wireframe modelling;	
	SECTION C: PCB Manufacturing	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1.Brian C. Benton, George Omura (2020), Mastering AutoCAD 2021 and AutoCAD LT 2021, John Wiley & Sons. 2.Chandra A.M., Chandra S. (2015), Engineering Graphics, 4th Edition, Alpha Science International Ltd. Additional references supporting the course 1.Onstatt, S. (2017) AutoCAD 2018 and AutoCAD LT 2018 Essentials, John Wiley & Sons, Incorporated. 2.Coombs, C. F. (2008). Printed Circuits Handbook, 6th Edition. McGraw-Hill Professional Publishing. 3.Bertoline, G. R. (2006), Introduction to graphics communications for engineers, 3rd Edition, McGraw-Hill.

1.	Name of Course :	ENGLISH FOR TERTIARY STUDIES
	Course Code :	BJEL1513
2.	Synopsis :	This course will expose students to the fundamentals of listening and reading skills, as well as basic foundation in grammar and vocabulary to enhance their language proficiency and enable them to cope with their studies in English at tertiary level. (CEFR Mid B2)
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Present themes, messages or main points based on selected videos. (A2, PLO9)
	CLO2	Explain the use of grammar components in various texts. (A3, PLO9)
	CLO3	Present personal views based on the content of selected articles. (A2, PLO9)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1									✓					
CLO 2									✓					
CLO 3									✓					

7

Course Content Outline

Grammar:
- Revisit Subject Verb Agreement (SVA)
- Modal Verbs
- Phrasal Verbs
- Collocations
- Tenses:
  - Simple Present
  - Present Continuous
  - Simple Past
  - Past Continuous
  - Present Perfect

Listening and Speaking Skills:
- Orientating yourself to the text
- Predicting the situation
- Listening to understand context
- Listening for specific information
- Predicting types of words needed
- Identifying main ideas
- Identifying details
- Understanding stress and intonation
- Identifying speaker's views, attitudes, and opinions
- Identifying facts and opinions
- Making inferences and drawing

	Reading and Vocabulary Skills: - Skimming and scanning for main idea(s) - Identifying details and examples to support an argument - Making inferences and predictions based on information in the text - Identifying the purpose of a paragraph or text - Distinguishing fact from opinion - Interpreting text for author's intention, attitudes and style - Inferring meaning from unfamiliar words - Analysing prefixes and suffixes - Deducing meaning from context - Connotative meaning of words	
	Writing Skills - Spelling and punctuations	
8	References (include required and further readings, and should be the most current)	1. McWhorter, K. and Sember, B., 2020. College reading and study skills. 14th ed. New York: Pearson. 2. Gaudart, H. et.al. 2019. Towards Better English Grammar Third Edition. Selangor: Oxford Fajar Sdn. Bhd. 3. Hughes, J., Stephenson, H.& Dummett, P., 2019, Life Intermediate Student's Book, 2nd Edition, National Geographic Learning, Hampshire. 4. Goldstein, B., Jones, C., Eckstut, S., Ball, R., Flores, C.C., Schwartzberg, N., 2019, Evolve Level 4 Full Contact. Cambridge University Press.

1.	Name of Course :	ANALOGUE ELECTRONICS
	Course Code :	BTEH1023
2.	Synopsis :	This course provides students with a fundamental knowledge in analysing and designing of simple analogue electronic circuits. Core topics include design amplifiers to meet frequencies specification, power amplifiers, features and operating characteristics of operational amplifiers and its applications.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEH1013
5	Course Learning Outcomes (CLO) :	
	CLO1	Classify field effect transistor amplifier circuits (C3)
	CLO2	Construct op-amp circuits based on the required design specifications (C3)
	CLO3	Construct different op-amp oscillator circuit configurations (C3)
	CLO4	Construct various classes of power amplifiers (C3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2	✓													
CLO 3		✓												
CLO 4	✓													

7 **Course Content Outline**

Field Effect Transistors

- JFET-p-channel and n-channel structures, device operation, drain source characteristics. Biasing as an amplifier circuit. Equivalent circuits.
-Depletion type and enhancement type, device action and characteristics, PMOS, NMOS, CMOS
circuits. Circuit symbols, identification and testing, handling precautions.
- MOSFET biasing and a simple amplifier circuits. CMOS logic circuits, inverter, OR, AND gates. Comparison of CMOS and TTL gates.

Operational Amplifiers

- Ideal and non-ideal characteristics and modes of operations, inverting, non-inverting, voltage follower configurations.
- Applications - comparators, summing amplifiers, integrators, differentiators and difference amplifiers.

Negative Feedback amplifier

-Voltage-derived feedback, Effect of feedback on gain, distortion, frequency response, input and output impedance.
- Application - linear audio amplifier.

Oscillator circuits and positive feedback

- Causes of instability (oscillation) in negative feedback amplifiers. Barkhausen's criterion and conditions necessary for sustain oscillation.
Stability of frequency and amplitude of oscillation.
- Design of RC ladder and Wien bridge phase shift oscillators,
- LC oscillators to meet frequency and amplitude specification.
- Brief introduction to simple crystal oscillator circuits.

	Power Amplifiers -Small signal amplifiers H-parameter and r-parameter conversion. Effects of coupling and bypass capacitors. Low Frequency response of BJT amplifiers. Effects of transistor's internal capacitors. - High frequency hybrid-pi model. High Frequency response of BJT amplifiers. -Audio power amplifier design. Collector dissipation and thermal considerations. Class A, B and AB biasing. -Cross over distortion. Biasing requirement of a complementary emitter follower push-pull output stage. Output power and efficiency determination from load-line for Class A operation. - Concept of matching for maximum power transfer to load / loudspeaker, tolerated power amplifiers specifications.	
8	References (include required and further readings, and should be the most current)	1. Thomas L Floyd, 2018. Electronic Devices (conventional current version), 10th Edition, Pearson 2. Robert L. Boylestad, Louis Nashelsky, 2013. Electronic Devices and Circuit Theory, 11th Edition, Pearson.

1.	Name of Course :	APPLIED ENGINEERING MATHEMATICS
	Course Code :	BTGE1023
2.	Synopsis :	In this course, students will learn Calculus and its applications. Topics include differentiation and applications, integration techniques, applications of integration, numerical integration, first and second order differential equations, test for convergence of series, Taylor's series, Maclaurin series and partial derivatives.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	NIL
5	Course Learning Outcomes (CLO) :	
	CLO1	Apply differential calculus. (C3, CTPS)
	CLO2	Apply integral calculus. (C3, CTPS)
	CLO3	Solve differential equations. (C3, CTPS)
	CLO4	Solve problems involving series. (C3, CTPS)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2	✓													
CLO 3	✓													
CLO 4	✓													

7

Course Content Outline

Differentiation
-Functions, limits, continuity.
-Differentation rules: product, quotient, composite function
-Differentiation of common functions including polynomials, trigonometric, exponential and logarithmic functions
-Inverse trigonometric functions, Hyperbolic functions, inverse Hyperbolic functions and their derivatives
-Differentiation of parametric equations and implicit functions.

Applications of differentiation
-tangent and normal,
-approximation involving small changes,
-related rate of change,
-Maxima and minima.
-Curve sketching, asymptote

Integration
-Integration by substitutions, partial fractions, integration by parts and reduction formulae.
-Numerical integration: Trapezoidal rule and Simpson rule

Applications of Integration
-Applications to areas, volumes,
-length of curves, area of surface of revolution,
-mean and root mean square values,
-centroids and centres of gravity

	Differential equations: -Ordinary differential equations, formation from physical problems. -Solution of first-order equations: Separation of variables, homogeneous equation, linear equation by integrating factor -Numerical method. 1st order equation by Euler method -Second-order ODE's with constant coefficients. -Particular integral by method of undetermined coefficients	
	Series: -Sequences and series	
	Partial Differentiation -Function of several variables -Partial derivatives -first and second orders. -Chain Rule	
8	References (include required and further readings, and should be the most current)	Main references supporting the course: 1. G. James, Modern Engineering Mathematics, 6th edition, Pearson (2020). 2. Marvin L. Bittinger, David J. Ellenbogen and Scott. A. Surgent, (2020) Calculus and Its Applications, 11th edition, Pearson. Additional references supporting the course: 1. G. B. Thomas, M. D. Weir and J. R. Hass, Thomas' Calculus, 14th edition, Pearson (2018). 2. A. Croft and R. Davidson, Mathematics for Engineers, 5th edition, Pearson (2019)

1.	Name of Course :	MICROPROCESSOR SYSTEMS
	Course Code :	BTEH1223
2.	Synopsis :	This course provides students with fundamental knowledge on the working principles of modern microprocessor systems. Core topics include internal architecture of the microprocessor systems, peripheral interfacing and programming in assembly language and C.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Describe the architecture and operation of contemporary microprocessor systems. (C2,PLO1)
	CLO2	Write assembly language/C programs for proper peripheral interfacing to the microcontroller to meet specific requirements. (C3,PLO3)
	CLO3	Simulate and test a microcontroller system using computer-aided design tool. (P4,PLO5)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2			✓											
CLO 3					✓									

7

Course Content Outline

Introduction
- Characterization and applications of microprocessors and microcontrollers
- Components and features of microcontrollers
- Von Neumann and Harvard architectures
- CISC and RISC architectures
- Manufacturers of microprocessors and microcontrollers

Microcontrollers
- Main characteristics: ALU & registers, machine cycle, instruction execution, oscillators, configuration bits, reset option, low power consumption, watchdog timer
- Microcontroller families

Memory in microcontrollers
- Basic concept: logic organisation and types of memory
- Program memory

Programming the microcontroller
- Basic concepts: machine code and assembly language, structure of instruction, data addressing modes, stack
- Instruction set for data transfer, arithmetic and logical operations, control transfer (conditional and unconditional branching, subroutine calls, return), bit manipulation and others.
- Assembly language Elements: expression & operators, directives, macroinstruction, program organisation.
- Resources for programming the microcontroller: text editor, assembler, linker, library manager, simulator/debugger, programmer

Parallel input/output resources
- Basic concepts: peripherals, port structure, data transfer techniques
- Input/output techniques: programmed vs interrupt
- Working with ports for data and signal transfer
- Peripheral connections, hardware and software interfacing designs for switches, LEDs, hex keypads, 7-segment LED, LCD etc

	Timers and Interrupts • Timer function & specifications • Control and operation • Uses of timers: delay and counter • CCP modules	
	Serial Input and Output • Serial data communication • Synchronous and non-synchronous	
	Data Acquisition and Distribution • Data acquisition system: sensors/transducers, ADC, attenuators, MUX, input protection and filters • Data distribution system: DAC, analogue DEMUX, PWM, output protection. • Programming examples	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Tam Hanna, Microcontroller basics with PIC, Elektor 2020 2. Martin Bates, Interfacing PIC microcontrollers : embedded design by interactive simulation, 2nd edition, Newnes / Elsevier 2014. (out of print) Additional references supporting the course 1. Fernando E. Valdes, Perez Ramon Pallas-Areny, Microcontrollers – Fundamentals and Applications, CRC Press 2009 2. Tim Wilmshurst, Designing Embedded Systems with PIC microcontrollers – Principles and Applications, Newnes 2010 3. Muhammad Ali Mazidi, Rolin D. McKinlay, Danny Causey, PIC Microcontroller and Embedded Systems, Pearson International 2008. 4. Ajay V. Deshmukh, Microcontrollers – Theory and applications, McGraw Hill 2005.

1.	Name of Course :	ELECTRICAL TECHNOLOGY
	Course Code :	BTEE1513
2.	Synopsis :	The course covers the concepts of electric circuits, electrical machines, power distribution systems, transformers, networks theory and transmission lines.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Apply electric circuit theorems. (C3)
	CLO2	Analyse electric circuit networks through modern software approach. (P3)
	CLO3	Describe the operation of electrical machines. (C3)
	CLO4	Evaluate elementary operational performance of power transformers and three-phase systems. (C3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2					✓									
CLO 3	✓													
CLO 4		✓												

7 **Course Content Outline**

Electric Circuits
· Steady-state single-phase sine a.c. networks.
· Resistance, reactance, impedance, phase-angle and frequency response plot.
· RLC resonance, Q-factor and Bandwidth.
· Active, reactive, apparent, power factor.
· Solution of simple network problems by phasor and complex number representations.
· Mesh and nodal analysis
· System response using differential equations.
· First order circuits, transfer function in standard form.
· Transient and steady state response of first order circuit to unit step input, sinusoidal input.

Industrial Electrical Diagrams
· Introduction to Industrial electrical diagrams.
· Ladder diagrams, wiring diagrams, single-line diagrams, motor connections and terminology.

Power Transformers and Thee-Phase Systems
· Principles of transformer operation.
· Emf equation of a transformer.
· Leakage flux. Transformer ratings and efficiency.
· Impedance transformation.
· Open circuit, short circuit tests.
· Voltage regulation, power factor.
· Phasor diagram under no load and loaded conditions.
· Three-phase systems.
· Relationships between line and phase voltages in star and delta connected system with balanced load.

	Introduction to Electrical Machines · AC generators: generation of single-phase and three phase ac voltage. · DC generators: characteristics of separately excited type, self-excited type. · DC motors: characteristics of permanent magnet, series and shunt type. · Motor speed control: DC motor control, field control, and armature control. · AC motors: characteristics of induction motors, motor selection, installation and maintenance. · Contactors and motor starters: magnetic contactor, symbols, construction, ratings, applications, solidstate contactor. · Magnetic Motor starters: construction, control circuits and overload protection devices. · Introduction to motor control: motor starting, motor stopping. · Principles and applications of stepping motor, servo motor and drive circuits.	
	Network Theory · Introduction to network theories. · Iterative, image and characteristic impedance. · Image transfer coefficient. · Insertion loss. · Attenuators	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Alexander, CK 2021, Fundamentals of Electric Circuits, 7th Edition, McGraw-Hill (2021), New York. 2. Boylestad, RL 2016, Introductory Circuit Analysis, 13th Edition, Pearson / Prentice Hall (2016), New Jersey. 3. Chapman SJ 2012, Electric machinery Fundamentals, 5th Edn, McGraw Hill (2012), New York. Additional references supporting the course 1. Wildi, T 2006, Electrical Machines, drives and power System, 6th Edition, Pearson / Prentice Hall, New Jersey. 2. Floyd, TL 2010, Principles of Electric Circuits : Conventional Current Version , 9th Edition, Pearson / Prentice Hall, New Jersey. 3. El-Hawary, ME 2002, Principles of electric machines with power electronic applications, 2nd Edn, Wiley-IEEE Press, New Jersey.

1.	Name of Course :	PROGRAMMING FOR ENGINEERS
	Course Code :	BTGE1043
2.	Synopsis :	This course introduces students to a structured approach to programming to explore applications developed using programming language in engineering and technology.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil

5 Course Learning Outcomes (CLO) :

CLO1	1. Apply the programmable algorithms using control structures and functions. (C3)
CLO2	2. Implement arrays, pointers, file I/O and simple algorithms in computer programs. (C3)
CLO3	3. Encode the devised solutions to simple computing problems into computer programs using integrated development environment (IDE). (P4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2	✓													
CLO 3					✓									

7 **Course Content Outline**

Introduction:
-Brief history of computing and introduction to programming language.
Familiarization with IDE:
-Introduction to the programs development processes
Data types and variables
- Study of data types and variables, variable declarations, operators and expressions.
Operators and expression:
- Arithmetic, relational, logical, assignment and other operators.
-Study of the various expressions used in conjunction with the operators.
Tools used to document program logic:
- Flowchart
- Pseudo code

Control Structure (Selection):
-Control structure statements and blocks such as IF statements, ELSE statements, MULTIPLE IF statements, SWITCH statements.
Control Structure (Repetition):
- Control structure statements and blocks such as FOR loop, NESTED FOR loop.
- Control structure statements and blocks such as WHILE loop, DO WHILE loop.

Functions:
-Functions and program structure.
- The syntax and concepts of using functions, parameter passing, external variables and the scope of the variables.
- Make function call by value and by reference.
- Use of standard header files and user defined header files.

Pointers and Arrays:
-Study of one dimensional arrays and multi-dimensional arrays.
- Passing array to function
- Study of pointers and arrays.
- Pointers and addresses.
-Pointer arrays & Pointers to functions.
Sorting and Searching Algorithm
- Bubble sort (Sinking sort)
- Selection Sort

Advance Input and output:
- Standard I/O

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Slobodan Dmitrovic, (2020), Modern C++ for Absolute Beginners, Apress 2. D. S. Malik, (2018),C++ Programming: Program Design Including Data Structures, 8th Edition, Cengage Learning Additional references supporting the course 1. P. J. Deitel, H. M. Deitel, (2017), C++: How to program, 10th Edition, Pearson 2. D. S. Malik, (2018), C++ programming: from problem analysis to program design, 8th Edition, Cengage Learning"

1.	Name of Course :	ACADEMIC ENGLISH
	Course Code :	BJEL1523
2.	Synopsis :	This course will expose students to the essential communication skills, as well as a appropriate vocabulary and grammar to enhance their language proficiency and enable them to cope with their studies in English at tertiary level. (CEFR B2)
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Participate effectively in class discussions using stimulus given. (A2, PLO9)
	CLO2	Explain the use of grammar components in various texts. (A3, PLO9)
	CLO3	Prepare a writing portfolio using the writing process approach. (A4, PLO9)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1									✓					
CLO 2									✓					
CLO 3									✓					

7 **Course Content Outline**

Listening Skills

- Listening for contrasting ideas
- Listening for examples
- Listening for reasons and explanations
- Listening for cause and effect
- Recognising speaker's attitude, bias, view or intention
- Recognising facts and opinions
- Making predictions
- Making inferences and drawing conclusions
- Note completion
- Table and Diagram completion
- Summarising

Speaking Skills

- Speaking with confidence and without unnecessary hesitation
- Knowledge of discourse, cohesion and coherence and text types
- Using language appropriate for the intended purpose and audience
- Using grammatical correct language in report
- Using correct pronunciation, stress and intonation for a news report
- Using varied sentence structures for a news report
- Using passive and active sentences in a news report
- Using appropriate verbal phrases for a group discussion. (participial phrase)
- Using persuasive devices in a group discussion. (flattery, hyperbole, imperative command, rhetorical question)

	Writing Skills - Discursive Writing - Argumentative Essay - Persuasive language in Writing - Proofreading essays or articles - Using cohesive devices in email writing - Organising and developing ideas for email writing - Apply appropriate English expressions in formal emails and letters - Using reported speech in writing minutes of meeting. - Choosing appropriate reported verb and tense in writing minutes of meeting - Using appropriate verbal phrases in writing minutes of meeting (gerund phrase) - Gathering information for minutes of meeting - Introducing reflective writing (Analytical practice where the writer describes an event/scene/thought and adds a personal reflection on its meaning)	
	Grammar - Prepositions - Adjectives	
	Reading and Vocabulary Skills - Identifying details and examples to support an argument - Identifying the purpose of a paragraph or text - Interpreting text for author's, intention, attitudes and style - Deducing meaning from context	
8	References (include required and further readings, and should be the most current)	1. Barker, A 2019, Improve Your Communication Skills, 5th edn, Kogan Page, London. 2. Langan, J 2023, College writing skills with Readings, 11th edn, McGraw-Hill, New York. 3. Stephenson, H, Dummett, P & Hughes, J, 2019, Life: intermediate, 2nd edn, Cengage Learning, Singapore. 4. Theobald, T 2019, Develop your Presentation Skills, 4th edn, Kogan Page, London. 5. Hendra, LA, Ibbotson, M, O'Dell, K, Flores, CC, Lewis, M, Barksdale, JL, Farmer, J, Paramour, A, 2020, Evolve Level 5 Full Contact, Cambridge University Press, Cambridge.

1.	Name of Course :	PROJECT MANAGEMENT AND FINANCE
	Course Code :	BGGE2044
2.	Synopsis :	This course covers the fundamentals principles and the practical tools for project management and finance. For project management part, it includes the concepts, processes, tools and techniques within the body of knowledge of project management for the entire project management cycle from initiation, planning, execution, monitoring and closure of projects. For the finance part, it includes the theories related to finance for projects, tools that are useful for project budgeting, develop of project cash flow, capital budgeting techniques for project analysis and evaluation.
3	Credit Value :	4
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Describe the processes of project management within the body of knowledge of project management. (C3)
	CLO2	Apply appropriate tools and techniques in project management processes. (C3)
	CLO3	Apply financial concepts, tools and techniques for project financial and capital budgeting analysis. (C3)
	CLO4	Develop a project proposal / project plan for an engineering related project. (C5)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1												✓		
CLO 2												✓		
CLO 3												✓		
CLO 4												✓		

7

Course Content Outline

An Introduction and Overview to Project Management

- Definition of project and project management, Project management body of knowledge
- Project hierarchy and Project management office (PMO)
- Relationship between project Management and operation management
- Business value
- Role of project manager: responsibilities, competencies and interpersonal skills

Organisational Influences and Project Life Cycle

- Project structure, organization, and culture,
- Project stakeholders and governance
- Project team
- Project life cycle and project feasibility
- Project Management Processes

Initiating

- Develop Project Charter

- project objectives and management intent, deliverable and end results, milestones, requirements, limits and exclusions and review with customers

- Identify Stakeholders

- Preparation of Stakeholder register

Finance

An Introduction and Overview of Finance in Project Management
- Definition and type of business finance
- Introduction to Financial management, objectives, scope and benefits of financial management
- Project finance and importance of project finance

Financial and Cost Concept for Project Analysis
- Time value of money
- Present / Future / Compound worth of single and annuity value
- Interest rate/ the cost of capital / rate of return
- Cost concepts, cost classification and cost behaviour
- Depreciation and effects of taxes

Project Planning

Plan Scope Management
- Defining the project scope:

- establish a project organization, assigning a PM, outline responsibilities and project team, Collect Requirements

Create WBS
- develop work breakdown structure (WBS)

Plan Schedule Management / Project scheduling

Financial and Cost Concept for Project Analysis (continue)
- Time value of money
- Present / Future / Compound worth of single and annuity value
- Interest rate/ the cost of capital / rate of return
- Cost concepts, cost classification and cost behaviour
- Depreciation and effects of taxes

Plan Schedule Management / Project scheduling
- Program Evaluation and Review Technique (PERT, Standard Deviation), fast tracking and crashing
- Use of project management software.

Plan Cost Management, Estimate Costs and Determine Budget
- estimating costs

- tools to estimate cost in project management
- Analogous Estimation, Parametric Estimation, Three Point Estimating and Bottom-up Estimation

Plan Quality Management
- cost-benefit analysis, Cost of quality, seven basic quality tools, benchmarking

Project budgeting and project cash flows
- Project budgeting techniques
- Developing project budgets

Plan Human Resource Management
- Human Resource Management
- Managing conflict and conflict resolutions

Plan Communications Management
- Communication models and communication methods

Plan Risk Management
- Risks identification: brainstorming, Delphi technique, SWOT analysis
- Risk Analysis: qualitative and Quantitative
- Failure Mode and Effect Analysis (FMEA)

Plan Procurement Management

Financial Analysis Techniques for projects
- Concepts and Decision Analysis Techniques

Project Executing
- Direct and Manage Project Work
- Perform Quality Assurance
- Human Resource Management- Managing conflict and conflict resolutions
- Manage Communications
- Conduct Procurement
- Manage Stakeholder Engagement

Project Monitoring and Control
- Monitor and Control Project Work
- Planning-monitoring-controlling cycle, designing the monitoring system, monitoring methods, data collection.

Perform Integrated Change Control

Financial Analysis Techniques for projects
- Capital Budgeting Techniques
  - Non-discounted methods

Control Schedule and Costs
- Tracking
- Earn value Management: Planned value, Earned value, Actual cost, Schedule variance, Cost variance, Schedule performance index, Cost performance index

Control Quality
- Seven basic quality tools, statistical sampling, inspection and review of change request

Control Risks
- Risk Responses, risk monitoring and control

Control Procurement
- Contract change control system, procurement performance reviews, inspections and audits, payment and claim administration

Control Stakeholder Engagement

Financial Analysis Techniques for projects (continued)
- Capital Budgeting Techniques
  - Non-discounted methods
  - Discounted methods

Project Closure
Close Project or Phase
- Varieties of project closures, project closure process and project final report.
Close Procurement – procurement audits, negotiations and documentation.

Introduction to PMBOK Guide 7th Edition - The 12 Principles and 8 Domains

Financial Analysis Techniques for Projects (continue)
- Break Even Analysis

Guest Lecture OR Site Visit

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Jack R. Meredith, Scottt M. Shafer. Samuel J. Mantel Jr. Margaret M Sutton (2020), Project Management in Practice, 7th Edition, Wiley. 2. Harold Kerzner, (2022y), Project Management: A Systems Approach to Planning, Scheduling, and Controlling 13th Edition, Wiley. 3. A Guide to the Project Management Body of Knowledge (PMBOK® Guide) — Sixth Edition, (2018), Project Management Institute. 4. Jack R. Meredith, Samuel J. Manterl, Jr (2016), Project Management - A Managerial Approach, 9th Edition, Wiley. 5. John A. White, Kellie S. Grasman, et al, (2020), Fundamentals of Engineering Economic Analysis, 2nd edition, Wiley Additional references supporting the course 1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide) — Seventh Edition, (2021), Project Management Institute. 2. Erik W Larson. (2018), Project Management – the managerial process, 7th Edition, McGraw Hill. 3. Blank, L. T. & Tarquin, A. (2018), Engineering Economy, 8th Edition, McGraw Hill, New York, United States. 4. Don Newnan, Ted Eschenbach, et al, (2019), Engineering Economic Analysis, 14th Edition, Oxford University Press.

1.	Name of Course :	ADVANCED ENGINEERING MATHEMATICS
	Course Code :	BTGE2013
2.	Synopsis :	In this course, students will learn multivariate calculus, partial derivative, multiple integrals, vector analysis, integral theorems, Laplace transform and its application for solving initial value problems, partial differential equations, Fourier series and its use in solving boundary value problems, Fourier transform, Z-transform and their applications.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTGE1023
5	Course Learning Outcomes (CLO) :	
	CLO1	Apply mathematical principles and techniques to solve problems arising from engineering applications. (C4)
	CLO2	Convert complicated and difficult problems into simpler ones using a mapping or a transformation to make problems more easily solvable. (C4)
	CLO3	Solve problems, particularly initial value problems and boundary value problems, involved in engineering and technology. (C4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2	✓													
CLO 3	✓													

7

Course Content Outline

Function of multivariables
- Sketching of surfaces z = f(x,y) or f(x,y,z) = 0 in the 3D space.
- Chain Rule of Partial Differentiation
- Lagrange Multiplier Method
- Leibnitz's Rule
- Multiple Integrals
- Coordinate systems : Cartesian coordinates

Vector Calculus
- Vector Differentiation : Gradient of a scalar field, Divergence and Curl of a vector field.
- Vector Integration : Line Integral, Green's Theorem Surface Integrals, Gauss Divergence Theorem.

Laplace Transform
- Unit Step functions, Causal functions Impulse functions
- Laplace transform of simple functions
- Properties of Laplace transform
- Inverse Laplace transform
- Application of Laplace transform to initial value problems

z-transform
- Causal sequences
- Formulae of z-transform
- Properties of z-transform

Fourier Series
- Fourier series expansion
- Even and odd functions
- Full-range and half-range Fourier series expansion of a function defined over a finite interval

Fourier Transform
- Fourier integral. Fourier cosine and sine integrals
- Fourier transform and inverse
- Properties of Fourier transform

	Partial Differential Equations • Classification of Partial Differential equations • Technique of separation of variables (SOP) • Solution to Boundary Value Problems by SOP	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. O'neil P, V. 2018. Advanced Engineering Mathematics, 8th Edition, Cengage. 2. Zill D, G. 2020. Advanced Engineering Mathematics, 7th Edition, Jones & Bartlett Learning. Additional references supporting the course 1. Glyn James. 2018. Advanced Modern Engineering Mathematics, 5th Edition, Pearson/Prentice Hall. 2. Erwin Kreyszig. 2020. Advanced Engineering Mathematics, 10th Edition, John Wiley. 3. K.A. Stroud and Dexter J. Booth. 2020. Further Engineering Mathematics, 6th Edition, Bloomsbury Publishing PLC.

1.	Name of Course :	ANALOGUE SYSTEM DESIGN
	Course Code :	BTEE2013
2.	Synopsis :	The main objective of this unit is to further enhance the knowledge gain in electronic devices. Core topics including analyse FET amplifiers to meet system specifications, differential amplifiers, negative feedback amplifier, second order active filters, oscillators, Schmitt trigger circuits and multivibrators, Students will be exposed to CAD tools. analogue electronic circuits and systems.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEH1023
5	Course Learning Outcomes (CLO) :	
	CLO1	Analyse frequency responses of FET amplifiers. (C3)
	CLO2	Analyse the performance of op-amp based circuits. (C3)
	CLO3	Implement amplifier-based circuits to meet system specifications. (P3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2		✓												
CLO 3			✓											

7

Course Content Outline
Field Effect Transistor Amplifier, DC Biasing, Small Signal equivalent circuit, effects of coupling and bypass capacitors at low frequency, effects of transistor's internal capacitors at high frequency.
Differential amplifier, Basic BJT differential pair, DC analysis, ac Analysis, Differential mode gain, Common mode gain, CMRR, Current mirror
Operational Amplifier - Ideal and practical operationa amplifier. Applications of op-amp in inverting & non-inverting amplifiers and comparator. Second order active filter. Negative feedback amplifier and oscillator.
Voltage comparators, Schmitt trigger circuit. Mono-stable and astable multivibrators. 555 Timer based multivibrators

8	References (include required and further readings, and should be the most current)	References 1. Thomas L. Floyd, Electronic devices: conventional current version, 10th Edition, Pearson (2018) 2.Robert L. Boylestad, Louis Nashelsky, 2014, Electronic Devices and Circuit Theory, 11th Edition, Prentice Hall Additional references supporting the course 1. Donald A. Neamen, Microelectronic, 2012: circuit analysis and design, 4th Edition, ,McGraw Hill 2. Theodore F. Bogart, Jeffrey S, Beasley and Guilermo Rico, 2004 Electronic Devices and Circuits, 6th Edition, Prentice Hall.

1.	Name of Course :	CIRCUITS ANALYSIS
	Course Code :	BTEC2313
2.	Synopsis :	This course is the continuation of Electric Circuits. The main focus are advanced electrical circuit analysis with electrical theorem, Laplace and Fourier transform, Fourier series, time and frequency domain function/circuit analysis and analysis of two port networks.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTMR1313
5	Course Learning Outcomes (CLO) :	
	CLO1	demonstrate understanding of analysis techniques for resistive circuit. (C3,PLO1)
	CLO2	analyse DC and AC circuit with energy storage element. (C3,PLO2)
	CLO3	manipulate two-port parameters into larger circuit networks. (C3,PLO2)
	CLO4	use computer-aided design tools in circuit analysis. (P3,PLO5)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3		✓												
CLO 4					✓									

7

Course Content Outline

Electrical Network Theorems of Lumped Parameter Circuits:
• Circuit theorems such as node analysis, mesh analysis, Thevenin, superposition theorem and source transformation principle with dependent sources

Complete Response of Circuits with One Energy Storage Element:
• Source free RC and RL circuit
• Step response RC and RL circuit

Complete Response of Circuits with Two Energy Storage Elements:
• Source free series and parallel RLC circuit
• Step response series and parallel RLC circuit

Sinusoidal Steady State Analysis:
• Phasor relationships for circuit elements
• Application of circuit theorems using phasors

Laplace & Fourier Transform Analysis:
• Properties of Laplace transform
• Inverse Laplace transform
• Circuit analysis using Laplace transform
• Properties of Fourier transform

Two-port Representation:
• Manipulation of two-port parameter

8	References (include required and further readings, and should be the most current)	Main references supporting the course Charles K. Alexander & Matthew N.O. Sadiku, Fundamentals of Electric Circuits, 7th Edition, McGraw-Hill. (2021) Additional references supporting the course J. David Irwin, R. Mark Nelms. Engineering circuit analysis, 11th Edition, John Wiley. (2015) Richard C. Dorf & James A. Svoboda, Introduction to Electrical Circuits, 9th edition, Wiley. (2013) Robert L. Boylestad, Introductory Circuit Analysis , 13th Edition , Prentice Hall. (2015)

1.	Name of Course :	ELECTRICAL MACHINES
	Course Code :	BGEE3513
2.	Synopsis :	Electrical machines are the main work horse and widely used in industrial applications. As such, this course will equip students with the knowledge and skills in electromechanical energy conversion system with the objective of studying the devices used in the inter-conversion of electric and mechanical energy.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	demonstrate the understanding in the underlying principles associated with various general purpose electrical machines (C3).
	CLO2	analyse various electrical machines in the applications of motor and generator (C3).
	CLO3	investigate the expected performance of direct current and asynchronous machines (C3).

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3				✓										

7

Course Content Outline

Units of measurements
- SI-English units system
- conversion of units.
- per unit measurement system.

Fundamental of Magnetism

Fundamental of Magnetism
- Residual Flux.

Introduction to Machinery Principles
- Types of machines.
- Basic rotor and stator, slot.

DC Machinery Fundamentals
- Simple rotating dc machine.
- Induced torque in the rotating loop.

DC Machinery Fundamentals
- Armature reaction.
- The internal generated voltage and induced torque if real dc machines.
- Power flow and losses in dc machines.

DC Generators
- DC generator operation, induced voltage.
- Neutral position, Armature reaction, commutating poles, machine saturation.
- Equivalent circuits, shunt, compound and differential compound generator.

DC Motors
- DC motor operation, counter-EMF, power and torque, speed control.
- Shunt, series and compound motor.
- Motor starting and reversing, dynamic braking, plugging.

DC Motors
- Mechanical time constant, 4-quardrant motor operation.

Three phase AC Induction Motor
- Introduction, principle machine components.

Three phase AC Induction Motor
- Starting characteristic, synchronous speed, rotor acceleration, slips, equivalent circuits.
- Application of induction motor.
- Starting and plugging of induction motor, DC braking

	Three phase AC Induction Motor • Wound and squirrel cage motor.	
	Synchronous Generator • Rotor construction. • Field excitation, no-load saturation curve.	
	Synchronous Generator • Per-unit impedance. • Synchronization of generator, transient model.	
	Synchronous Motor • Excitation and reactive power. • Effect of excitation, V-curve	
	Stepper Motor and Reluctance Drives • Basic torque production mechanism for reluctance effect and permanent magnet machine. • Relationship between machine and step angle. • Circuit necessary for current pulse control. • Commutation sequences and control.	
8	References (include required and further readings, and should be the most current)	1. Gieras, Jacek F.,Electrical machines : fundamentals of electromechanical energy conversion, 1st Edition, CRC Press (2017) 2. Bhattacharyya, Mrittunjay., Electrical Machines : Modelling and Analysis, Kindle Edition, PHI Learning (2016). 3. Electrical machines, 3G E-Learning (2017) 4. Theodore Wildi, Electrical machines, drives and power systems, 6th Edition, Prentice Hall (2014)

1.	Name of Course :	COCURRICULAR ACTIVITIES
	Course Code :	COCU
2.	Synopsis :	Tunku Abdul Rahman University College believes in providing a holistic education. The moral, social and physical aspects of a student's life are as important as the student's academic and intellectual development. The Co-curricular course is compulsory for all students pursuing TAR University College's Diploma and Bachelor Degree programmes. Students are required to complete and pass two credit hours before they can graduate at every level of their studies. Students taking the Co-curricular course will be graded. However, the grades will not contribute to the GPA and CGPA.
3	Credit Value :	2
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	

6	**Course Learning Outcomes (CLO)**	**Programme Learning Outcomes (PLO)**													
		PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**		
7	**Course Content Outline**														
8	References (include required and further readings, and should be the most current)														

1.	Name of Course :	DIGITAL SYSTEM DESIGN
	Course Code :	BTEC2233
2.	Synopsis :	The main objective of this unit is to enhance the digital logic design knowledge in analyzing and designing of digital systems. Hardware description languages are introduce in system design.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEH1213
5	Course Learning Outcomes (CLO) :	
	CLO1	demonstrate the ability to program logic circuit based on HDL. (C3)
	CLO2	design combinational logic circuit based on discrete components, LSI and MSI devices. (C3)
	CLO3	design multi-input finite state machines. (C3)
	CLO4	implement HDL(Hardware Description Language) -based digital systems from system specification to final presentation. (P3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3			✓											
CLO 4					✓									

7

Course Content Outline

Logic Circuit Implementation using Hardware Description Language (HDL)

- Introduction to VHDL,
-Basic language organization,
-Interface, Architecture body,
- Design unit and libraries,
- Modelling styles, Structural Modelling in VHDL,
- Hierarchical structures, Data flow Modelling in VHDL,
- Behavioural Modelling in VHDL,
- Conditional concurrent signal assignment statement,
- Data flow and hardware parallelism

Combinational Logic Design (discrete logic gates and Standard MSI and LSI)

- Reduction techniques, Karnaugh maps (5 variables),
- Implementation of circuits with logic gates,
- Multiplexer/data selector, Multiplexer trees,
- Decoders/ demultiplexers, Decoder trees, Encoders, Priority encoders, Code converters, Comparators, Half and Full adders.

Synchronous Sequential Logic design.

- State diagrams and State tables, Simple state reduction methods, Synthesis using clocked RS, JK, T and D flip flops, Counters and multiple inputs finite state machines design. ASM chart, ASM block, relationship between ASM chart and state diagrams and state tables. Techniques in designing the control logic section of the ASM chart.

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Ronald J. Tocci, Neal S. Widmer, Gregory, Digital Systems:Principles and Applications, 12th Edition, Prentice Hall (2017). 2. Hwang, E.O., Digital Logic and Microprocessor Design with Interfacing. 2nd Edition. Cengage Learning (2018) 3. Rafiquzzaman, M. and McNinch, S.A.,. Digital Logic: With an Introduction to Verilog and FPGA-Based Design. John Wiley & Sons (2020). Additional references supporting the course 1. Brock J. LaMeres, Introduction to Logic Circuits & Logic Design with VHDL, Springer (2017) 2. Tokheim, R.L., Hoppe, P.E. Digital Electronics: Principles and Applications. 9th Edition McGraw-Hill (2022). 3. Roth Jr, C.H., Kinney, L.L. and John, E.B. Fundamentals of logic design. Enhanced Edition. 7th Edition. Cengage Learning (2020).

1.	Name of Course :	FURTHER ENGINEERING MATHEMATICS
	Course Code :	BTGE2023
2.	Synopsis :	This course provides further training on advanced mathematical techniques for engineering applications, including complex analysis, numerical methods and statistics. Such topics are essential for the study of engineering programmes. Complex analysis is used in the study of electromagnetic field theory. Numerical methods enable complex problems to be solved using computer programs. Probability and statistical techniques are for application to random processes. Objectives: To study advanced mathematical techniques for application in engineering. To lay the mathematical foundation for studying other courses in engineering programmes
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTGE2013
5	Course Learning Outcomes (CLO) :	
	CLO1	Solve problems involving complex variables, including contour integration. (C4)
	CLO2	Evaluate and Use eigenvalues and eigenvectors to simplify matrices with application to system of differential equations. (C4)
	CLO3	Apply numerical methods to solve algebraic equations, linear equations, differential equations, partial differential equations and optimisation problems. (C4)
	CLO4	Solve problems involving random processes using probability theory. (C4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2	✓													
CLO 3	✓													
CLO 4	✓													

7

Course Content Outline

Complex Analysis
• Complex Functions
• Complex Differentiation
Complex Analytic Functions
Cauchy Riemann Equations
Zeros and singularities of a complex function
• Complex Integration

Numerical Methods
• Numerical solution to simultaneous linear equations :
- Jacobi method
- Gauss-Seidel method
- Factoristion/ Decomposition methods
• Numerical solution to simultaneous nonlinear equations :
- Direct iteration method

Eigenvalues & Eigenvectors of a square matrix
- Characteristic equation
- Power method
- Inverse Power method
- Gerschgorin Theorem
• Application of Eigenvalues & Eigenvectors

	Numerical solution to initial value problems (IVP's) - Taylor method - Euler methods	
	Numerical solution to Partial Differential Equations - Finite Difference Approximations - Heat Equation (a) Direct method	
	Probability • Conditional probability • Random variable and expected value • Bivariate distribution	
	Stochastic process • general concepts of stochastic processes, Markov chain • one-steo transition matrx of stationary Markov chain • n-steo transition matrix of stationary Markov chain • Distribution of states • Regular Markov chain	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Glyn James et al.2011. Advanced Modern Engineering Mathematics. 4th Edition. Pearson/Prentice Hall. 2. O'Neil P.V. 2012.Advanced Engineering Mathematics.7th Edition. Cengage. Additional references supporting the course 3. Erwin Kreyszig, 2011. Advanced Engineering Mathematics. 10th Edition. John Wiley. 4. Stroud K.A., Booth D.J. 2013. Engineering Mathematics. 7th Edition. Palgrave MacMillan. 5. Gilbert Strang, Linear Algebra and its application 6. Athanasios Papoulis & S. UnnikrishnaPillai, Probability Random Variable and Stochastic Processes 7. Peyton Z. Peebles, Probability, Random Variables and Random Signal Principles

1.	Name of Course :	ELECTRICAL POWER SYSTEMS
	Course Code :	BGEE2614
2.	Synopsis :	This course provides students with a broad knowledge of the fundamentals of electrical power systems.
3	Credit Value :	4
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	explain the fundamental principles of generation, transmission, distribution and utilization of electric power. (C3,PLO1)
	CLO2	analyse electrical faults and ways to protect the system at optimum cost. (C4,PLO2)
	CLO3	investigating the impact of load variations in transmission system. (C4,PLO4)
	CLO4	analyse practical issues in modern power systems for maintenance of a stable, reliable, and efficient system. (C4,PLO11)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3				✓										
CLO 4											✓			

7

Course Content Outline

Introduction of Electrical Power Systems
- Generation, transmission and distribution and utilization
- Single phase vs three phase
- Balanced three phase circuits
- Y & -connected loads, and transformation.

Power Transformers & Transmission Line
- The Ideal Transformer
- Equivalent Circuits for Practical Transformers
- The Per-Unit System
- Autotransformer
- Transmission-line Design Considerations
- Line Resistance

Symmetrical Components
- Definition of Symmetrical Components.
- Sequence Networks of Impedance Loads.
- Sequence Networks of Series Impedances.

Symmetrical & Unsymmetrical Faults
- Series R-L Circuit Transients.
- Three-Phase Short Circuit (Unloaded Synchronous Machine). Power System Three-Phase Short Circuits.
- Circuit Breaker and Fuse Selection.
- System Representation.
- Single Line-to-Ground Fault.
- Line-to-Line Fault.

System Protection & Economic Dispatch
- System-Protection Components.
- Instrument Transformers.

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1.Md. Abdus Salam, Fundamentals of Electrical Power Systems Analysis, 1st Edition, Springer (2020). Additional references supporting the course 1. Theodore Wildi, Electrical Machines, Drives, and Power Systems, 6th Edition, Pearson Prentice Hall (2006). 2. Hadi Saadat, Power System Analysis, McGraw Hill (2004). 3. Alexandra von Meier, Electric Power Systems: A Conceptual Introduction, 1st Edition, John Wiley & Sons (2006). 4. J. Duncan Glover, Mulukutla S. Sarma, and Thomas Overbye, Power Systems Analysis and Design, 6thEdition, Cengage Learning (2017).

1.	Name of Course :	ELECTROMAGNETIC FIELDS
	Course Code :	BTEC2714
2.	Synopsis :	This course covers the essential principles of fundamental topics in electrostatic and magnetostatic fields
3	Credit Value :	4
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Classify electrostatic and magnetostatic laws. (C3)
	CLO2	Apply the static fields postulates to solve electrostatic and magnetostatic fields related problems. (C3)
	CLO3	Characterize electric field and magnetic field for a given geometry and boundary conditions. (C4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3			✓											

7

Course Content Outline
Coulomb's Law: Field intensity and flux density Electric fields due to continuous charge distributions
Gauss's Law: Application of Gauss's law, relationship between electric fields and electric potential, electric flux line and energy in electrostatic fields
Dielectric materials and polarisation, properties of materials conductors and dielectric.
Boundary conditions electrostatic boundary-value problems
Poisson's and Laplace's equations: General procedure for solving Poisson's and Laplace's equation, application of Poisson's and Laplace's equations in electrostatic problems
Capacitance: Solving problems for parallel plate, spherical capacitor and coaxial cable
Biot Savart's law: Applications of Biot Savart's law in line currents, surface current and volume current
Ampere's law: Applications of Ampere's law in infinite line current, sheet current and coaxial transmission line
Magnetic forces, torque and magnetisation magnetic materials: Diamagnetics, Paramagnetics and Ferromagnetics
Magnetic Boundary Conditions and Problem Solving
Inductors, inductance and magnetic energy
Magnetic circuits, analogy between electric circuits and magnetic circuits and reluctance

8	References (include required and further readings, and should be the most current)	Main references supporting the course: 1. Matthew N. O. Sadiku, Elements of Electromagnetics, 6thEdition, Oxford University Press (2018) 2. William H.Hayt, Engineering Electromagnetics, 8th Edition, Mc.Graw Hill (2019) Additional references supporting the course: 1. Fawwaz T.Ulaby, Fundamentals of Applied Electromagnetics, 6th Edition, Pearson (2010) 2. Fawwaz T.Ulaby, Electromagnetics for Engineers, Pearson (2005) 3. Clayton R. Paul, Introduction to Electromagnetic Fields, 3rd Edition, Mc Graw Hill (1998)

1.	Name of Course :	ENGLISH FOR CAREER PREPARATION
	Course Code :	BJEL2913
2.	Synopsis :	This course is designed to help students to develop their spoken and written communication skills in English for the tertiary level in preparing them for the real world. (CEFR C1)
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Demonstrate correct sentence structures, grammar and vocabulary in spoken communication (A3, PLO9)
	CLO2	Demonstrate correct sentence structures, grammar and vocabulary in written communication (A3, PLO9)
	CLO3	Propose ideas persuasively and critically in correct sentence structures, grammar and vocabulary (A5, PLO9)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1									✓					
CLO 2									✓					
CLO 3									✓					

7 **Course Content Outline**

Proposal Writing
- Types of proposals
- Reasons for writing proposals
- Format of a proposal

Structure and components of proposals
- Expressions for proposal writing
- Making suggestions and recommendations
- Reading sample proposals
- Future Tense “will” vs “going to”

Oral Presentation
- Types of speeches
- Choosing a Topic
- Knowing your audience
- Planning and organising content
- Transition markers
- Visual aids
- Vocal Features
- Verbal and non-verbal communication
- Handling questions
- Overcoming stage fright
- Language tips for an oral presentation

	Job Seeking Skills • Reading and writing job application letters • Reading and writing résumé • Common headings for curriculum vitae or résumé • Using action verbs to describe job responsibilities • Preparing for job interviews • Types of job interviews • Commonly asked questions • Using appropriate adjectives to describe personalities during a job interview • Dress code and appearance • Effective body language in a job interview • Understanding appropriate interview etiquette • Exercises on job-seeking skills
	Critical and Analytical Thinking Skills • Introduction to critical and analytical thinking skills • Importance of case studies in critical thinking • Tips to answer a case study • Using language of probability • Brainstorming and group problem-solving activities • Presentation of solutions • Extracting, discussing and summarising data • Giving opinions • Brainstorming and applying problem-solving strategies in work-related situations and case studies • Presentation of solutions • Sample Case study
	Meeting Skills • Purpose and procedures • Roles of chairperson, secretary and participants • Meeting Terminologies • Notice of meeting, agenda and minutes • Meeting languages: Form and functions • Managing conflicts and reaching consensus in meetings • Exercise on negotiating skills • Writing minutes • Reported speech: passive voice
8	References (include required and further readings, and should be the most current)
	1. Yap, YW, Fernandez, B, Aloysious M, Balakrishnan, S & Zainudin, ZZ 2021, Essentials of professional communication: Business and commerce, Cengage Learning, Singapore. Available at: https://www.vitalsource.com/ 2. Kolin, PC 2017, Successful writing at work, 11th edn, Houghton Miffin, Boston, MA. 3. Chan, M 2020, English for business communication, Routledge, New York. 4. Lynn, W 2018, Ultimate job search: Master the art of finding your ideal job, getting an interview and networking, 5th edn, Kogan Page, London. 5. Thill, JV & Bovee, CL 2017, Excellence in business communication, 12th edn, Harlow, Essex: Pearson.

1.	Name of Course :	CAPSTONE PROJECT
	Course Code :	BGEE3804_1
2.	Synopsis :	Students are expected to solve complex engineering problem and apply acquired engineering principles to the design of a system, component, or process in a collaborative setting which encompasses planning, division of work, and maintaining individual accountability within a framework of group success. Each project includes the development and use of design methodology, formulation of design specifications, consideration of alternative solutions, feasibility considerations and detailed system descriptions. Students are expected to present their results orally and document their solutions. A working prototype or simulation, as appropriate, of their solution is required to complete the course.
3	Credit Value :	4
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	analyse a complex engineering problem using first principles of mathematics, natural sciences and engineering sciences. (C4,PLO2)
	CLO2	design solutions for solving a complex engineering problem by incorporating considerations on public health and safety, society, environment and sustainability. (C6,PLO3)
	CLO3	understand the impact of engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development. (C6,PLO7)
	CLO4	evaluate health, safety, and legal issues on the project implementation. (C6,PLO6)
	CLO5	articulate project activities from conceptual idea to commercialization with considerations on cost, human resource and timeline management. (C6,PLO12)
	CLO6	apply ethical principles and professional norms in solving an engineering problem. (A4,PLO8)
	CLO7	demonstrate concerted project development through effective team working skills. (A4,PLO10)
	CLO8	present project deliverables effectively through oral and written modes. (P5,PLO9)
	CLO9	conduct tests and model solutions to complex engineering problems using appropriate modern tools. (P4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2			✓											
CLO 3							✓							
CLO 4						✓								
CLO 5												✓		
CLO 6								✓						
CLO 7										✓				
CLO 8									✓					
CLO 9					✓									

7 **Course Content Outline**

	Lectures on the following topics: - General Briefing - Proposal writing - Literature Search	
	Background study and problem statement with specifications and requirements.	
	Academic writing	
	Project Design, Instrumentation and Measurement Laboratories	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Ranjit Kumar (2019), Research Methodology: a step-by-step guide for beginners, 5th Edition, Sage Publications 2. Fink, A. (2014), Conducting Research Literature Reviews: From the Internet to Paper, 4th Edition, Sage Publications.

1.	Name of Course :	ENTREPRENEURSHIP
	Course Code :	MPU-3252
2.	Synopsis :	Entrepreneurs play an important role in bringing in economic changes and advancements to a country's economy. Specifically, job creation has been regarded as one of the major contributions of entrepreneurs. Various efforts have been put forward by governments to encourage entrepreneurial activities, especially for the youths. Offering entrepreneurship education is one of the many plans. This course will provide students with an understanding of the importance of entrepreneurship and the mechanisms to start an entrepreneurial venture. it is intended to mould students into potential entrepreneurs who are able to meet the challenges of the business world. Theories, techniques and practices of entrepreneurship are provided for students to resolve and manage issues related to their ventures. Course Objectives 1. To expose students to the role, nature and approach of entrepreneurship – from creating new ventures to managing businesses. 2. To be able to resolve issues related to entrepreneurship activities - financial and non-finan cial implications of different business operations. 3. To prepare students with the skills to develop, write and pitch/implement a business plan.
3	Credit Value :	2
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Examine the methods of generating new venture ideas in creating new businesses. (C3)
	CLO2	Describe the critical functional areas and business plans. (A1)
	CLO3	Propose the new venture idea and business plan to potential financiers and/or investors. (A3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2												✓		
CLO 3								✓						

7

Course Content Outline
Entrepreneurship: definition, evolution and personality
Creativity, Innovation and entrepreneurship
Understanding Start-up I
Understanding Start-up II
Preparing a business plan
The organisational plan
The marketing plan
Financial information and management

	Managing growth	
	ICT as a business tool	
	Contemporary issues	
	Industry Sharing- Pitching Skill	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1.Robert D. Hisrich, et al. 2019, Entrepreneurship, 11th edn, McGraw-Hill Education 2. Norman MS & Jeffrey R 2018, Essentials of Entrepreneurship and Small Business Management, 9th edn, Pearson

1.	Name of Course :	CONTROL SYSTEMS ENGINEERING
	Course Code :	BTGE3413
2.	Synopsis :	This course covers the modelling techniques and analysis of dynamic systems in time domain.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTGE2013
5	Course Learning Outcomes (CLO) :	
	CLO1	Represent a physical system in transfer function model. (C3)
	CLO2	Analyse the performance of SISO system in time domain. (C4)
	CLO3	Analyse the behavior of dynamic systems using state variable models. (C4)
	CLO4	Utilise computer aided toolsets to aid control system analysis. (P4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3		✓												
CLO 4					✓									

7

Course Content Outline

Modelling of Dynamical Systems
- Mathematical modelling of lumped parameter component, devices, and system (mechanical mass-spring-damper).
- Linearization of dynamical equations about an equilibrium operating state.
- Methods of representation: Block Diagrams and block diagram reduction, transfer function, signal flow graphs.

Timed domain response of dynamic systems
- Transient and steady state response of first order and second order systems to impulse, step and ramp inputs
- Analysis from transfer function and state variable formulations of system equations
- Response characteristics: Time constant, undamped and damped natural frequencies, damping ratio, settling time, rise time. Extension to higher order systems.

Feedback Control Systems
- Open and closed loop transfer function.
- Type number of a closed loop control system, relationship with steady state errors.
- Characteristic equation of a closed loop control system, Routh-Hurwitz stability criterion.

Root locus analysis
- Root locus diagram construction
- Stability criterion constraints on pole location

State-space
- State variable formulation of system equation, similarity transformation.
- Controllability and Observability.

Mathematical Modeling of Dynamic Systems
- Derivation of LTI models from mechanical, electrical or liquid systems.
- Linearisation of non-linear mathematical models

8	References (include required and further readings, and should be the most current)	1. Richard C. Dorf, Robert H. Bishop, Modern control systems,14th Edition, Pearson (2021) 2. Nise, N.S., Control Systems Engineering, 8th Edition, NY (2019) 3. Ogata, K, Modern Control Engineering, 5th Edition, Pearson (2010) *out of print 4. Ogata, K, System Dynamics, 4th Edition, Pearson/Prentice Hall (2004) *out of print

1.	Name of Course :	DIGITAL SIGNAL PROCESSING
	Course Code :	BGEC3314
2.	Synopsis :	This course presents the classification, analysis, and design of discrete time signals and systems. Major concepts covered include: Discrete-time processing of continuous-time signals, time-and frequency-domain design techniques for recursive (IIR) and non-recursive (FIR) filters, multirate techniques, and adaptive filters.
3	Credit Value :	4
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	explain the principles and techniques for discrete time processing. (C4)
	CLO2	analyse discrete time signals and systems in frequency domains and transform domains. (C4)
	CLO3	design IIR, FIR, adaptive and multirate system. (C6)
	CLO4	classify and characterize digital signals and systems. (C5)
	CLO5	model digital filters and systems with CAD tools. (P4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3			✓											
CLO 4				✓										
CLO 5					✓									

7

Course Content Outline

Introduction:
ADC/DAC, Sampling theorem, LTI properties, impulse response, difference equations, convolution, circular convolution spectral representations, correlation, autocorrelations, cross correlation

Fourier Transform:
Fourier Series (FS), Fourier Transform (FT), Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) application to signals and systems for analysis.
Development of the FFT algorithm from the DFT (Decimation in time and decimation in frequency)

System Analysis with Laplace and Z Transform:
Transfer Function, region of convergence, feedback systems, pole-zero plots, stability analysis to systems

Filter Design Techniques
Phase, group delay, and generalized linear phase

Multirate Signal Processing
Downsampling, upsampling, imaging and aliasing. Applications of multirate systems

Adaptive filters
Wiener filters, RLS, LMS, application of adaptive filtering

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Thomas Holton, Digital signal processing : principles and applications, Cambridge University Press, 2021 2. John G. Proakis, Dimitris K. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, 5th Edition, Pearson, 2022. Additional references supporting the course 1. Alan V. Oppenheim, Ronald W. Schafer, Discrete-time Signal Processing (Third Edition), 2014 2. Tomasz P. Zielinski, Starting digital signal processing in telecommunication engineering : a laboratory-based course, Springer. 2020

1.	Name of Course :	POWER ELECTRONICS AND DRIVES
	Course Code :	BTEE3513
2.	Synopsis :	Power Electronics and Drives is one of the specialised application areas of Electrical and Electronic Engineering. It is becoming more and more important and is the basis for many industrial processes, for the rational use of the energy, for new technologies in individual and mass transportation, areas that are rapidly growing requiring new concepts in order to fulfil cost, reliability, miniaturisation as well as environmental requirements. This course provides students with a broad knowledge of the principles of power electronics and drives. The core topics include semiconductor power devices, power electronics converters, and drives.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTGE2013
5	Course Learning Outcomes (CLO) :	
	CLO1	analyse the merits and disadvantages of the operation of semiconductor power switches and power electronic converters. (C4)
	CLO2	demonstrate an understanding on AC and DC drives. (C3)
	CLO3	design simple power electronic converters circuits used in various practical applications. (C6)
	CLO4	investigate various operating modes and configurations of power electronic converters through hands on practical. (C4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2	✓													
CLO 3			✓											
CLO 4				✓										

7

Course Content Outline

Introduction to Power Electronics
- Introduction.
- Types of control and power conversion.
- Basic configuration of power electronic converters.

Semiconductor power switches
- Power electronic switches classifications.
- Characteristics, properties and comparison.

Rectifiers, AC to DC conversion
- Single-phase uncontrolled and controlled rectifiers with RLE loads.
- Three-phase uncontrolled and controlled rectifiers with RLE loads.
- Control methods, Device selection and Supply review.

Cycloconverters, AC to AC conversion
- Single-phase and three-phase AC to AC conversions with various load conditions.

Choppers, DC to DC conversion
- Step down four quadrant choppers.

Switching power supplies
- Non-isolated switched mode DC to DC converter.
- Buck, Boost, Buck-boost, and Cuk power supplies.

	Inverters, DC to AC conversion • Single-phase and three-phase voltage and current source inverters. • Control methods, Device selection. • Spectral analysis of harmonic content in output parameters.	
	Drives • Single-phase and Three-phase AC and DC drives	
8	References (include required and further readings, and should be the most current)	1. Fang Lin Luo and Hong Ye, Power Electronics: Advanced Conversion Technologies, CRC Press (2018) 2. Muhammad H. Rashid, Power Electronics, Circuits, Devices and Application, 4thEdition (International Edition), Pearson (2014) 3. Stephen J. Chapman, Electric Machinery Fundamentals, 5th Edition, McGraw Hill (2012) 4. Ned Mohan, Tore M. Undeland, William P. Robbins, Power electronics: converters, applications, and design,3rd Edition, John Wiley (2003)

1.	Name of Course :	ENGINEER AND SOCIETY
	Course Code :	BGGE3713
2.	Synopsis :	The scope of an engineer has gone beyond the theoretical analysis and design into the holistic framework of integrating into society in general. It is therefore important for engineers to possess the skills and abilities to function as part of society, understand the impact of professional responsibilities and norms of engineering practice. Objectives This course will provide students the awareness on impact of their action on the environment and society in various aspects including assess of societal, health, safety, legal and cultural issue. This course will also acquaint them with their working environment so that they can achieve a relatively easy transition from undergraduates to working engineers.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Apply principles of ethics of a professional engineer in relation to society and norms of engineering practice. (C3)
	CLO2	Assess the impact of the technological developments with appropriate consideration for societal, health, safety, legal, cultural and environmental factors. (C4)
	CLO3	Evaluate the key issues in the use of natural resources from various aspects of sustainable development and practices. (C5)
	CLO4	Demonstrate the ability to work effectively in a workgroup. (A4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1								✓						
CLO 2						✓								
CLO 3							✓							
CLO 4										✓				

7

Course Content Outline
Professional engineer's ethical considerations. Code of Conduct of Registered Person.
Route to professional engineer registration, Registration of Engineers Act 1967 and Professional Bodies
Technology and Society
Utilisation of natural resources
Energy issues
Major environmental impacts
Pollution and waste disposal, mineral and miscellaneous raw material resources, water and land use
Industrial and engineering safety
Legal requirements

8	References (include required and further readings, and should be the most current)	1.Main references supporting the course : 1.Masten S.J. and Davis M.L., (2020), Principles of Environmental Engineering and Science, 4th ed., McGrawHill 2.Dunlap, R.s. (2019) Sustainable Energy, 2nd ed., Cengage 3.Ho, X and Chuah, CK.,(2021), Staying Safe at Work, Sunway University Press Additional references supporting the course 1.Moaveni, S. (2018), Energy, Environment, and Sustainability, Cengage Learning 2.Sorensen, B., (2016), Renewable Energy, Physics, Engineering, Environmental Impacts, Economics and Planning, 5th ed., Academic Press

1.	Name of Course :	CAPSTONE PROJECT
	Course Code :	BGEE3804_2
2.	Synopsis :	Students are expected to solve complex engineering problem and apply acquired engineering principles to the design of a system, component, or process in a collaborative setting which encompasses planning, division of work, and maintaining individual accountability within a framework of group success. Each project includes the development and use of design methodology, formulation of design specifications, consideration of alternative solutions, feasibility considerations and detailed system descriptions. Students are expected to present their results orally and document their solutions. A working prototype or simulation, as appropriate, of their solution is required to complete the course.
3	Credit Value :	4
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	analyse a complex engineering problem using first principles of mathematics, natural sciences and engineering sciences. (C4,PLO2)
	CLO2	design solutions for solving a complex engineering problem by incorporating considerations on public health and safety, society, environment and sustainability. (C6,PLO3)
	CLO3	understand the impact of engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development. (C6,PLO7)
	CLO4	evaluate health, safety, and legal issues on the project implementation. (C6,PLO6)
	CLO5	articulate project activities from conceptual idea to commercialization with considerations on cost, human resource and timeline management. (C6,PLO12)
	CLO6	apply ethical principles and professional norms in solving an engineering problem. (A4,PLO8)
	CLO7	demonstrate concerted project development through effective team working skills. (A4,PLO10)
	CLO8	present project deliverables effectively through oral and written modes. (P5,PLO9)
	CLO9	conduct tests and model solutions to complex engineering problems using appropriate modern tools. (P4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2			✓											
CLO 3							✓							
CLO 4						✓								
CLO 5												✓		
CLO 6								✓						
CLO 7										✓				
CLO 8									✓					
CLO 9					✓									

7	**Course Content Outline**

	Lectures on the following topics: - General Briefing - Proposal writing - Literature Search	
	Background study and problem statement with specifications and requirements.	
	Academic writing	
	Project Design, Instrumentation and Measurement Laboratories	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Ranjit Kumar (2019), Research Methodology: a step-by-step guide for beginners, 5th Edition, Sage Publications 2. Fink, A. (2014), Conducting Research Literature Reviews: From the Internet to Paper, 4th Edition, Sage Publications.

1.	Name of Course :	POWER SYSTEM ANALYSIS
	Course Code :	BTEE3623
2.	Synopsis :	This course further extends from Electrical Power Systems to cover transient related events of power systems and power flow control methods.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BGEE2614
5	Course Learning Outcomes (CLO) :	
	CLO1	analyse a simple interconnected power system with multiple sources and loads under steady state condition. (C4)
	CLO2	construct and analyse the power system network model through software tools. (C5)
	CLO3	analyse the impact of overload on the power system network and the dynamic principle of generators. (C4)
	CLO4	analyse the transient stability and transient operation of the power systems. (C4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2											✓			
CLO 3			✓											
CLO 4			✓											

7

Course Content Outline
Introduction of Power System Analysis
Transmission Lines (Steady-State Operation) ? Lossless Lines. ? Maximum Power Flow
Power Flow ? Direct Solutions to Linear Algebraic Equations: Gauss Elimination. ? Iterative Solutions to Linear Algebraic Equations: Jacobi and Gauss-Seidel. Power Flow (cont'd) ? Iterative Solutions to Linear Algebraic Equations: Jacobi and Gauss-Seidel. ? Iterative Solutions to Non-Linear Algebraic Equations: Newton-Raphson.
Power Flow (cont'd) ? The Power-Flow Problem using Jacobian and Newton Raphson method.
Transient Stability ? The Swing Equation. ? Simplified Synchronous Machine Model and System Equivalent. Transient Stability (cont'd) ? A Two-Axis Synchronous Machine Model.
Power System Controls ? Generator-Voltage Control.
Transmission Lines (Transient Operation) ? Traveling Waves on Single-Phase Lossless Lines. ? Boundary Conditions for Single-Phase Lossless Lines. Transmission Lines (Transient Operation) (cont'd) ? Bewley Lattice Diagram

	Power Distribution Analysis ? Primary Distribution. ? Secondary Distribution. Power Distribution Analysis (cont'd) ? Transformers in Distribution Systems	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. J. Duncan Glover, Mulukutla S. Sarma, and Thomas Overbye, Power Systems Analysis and Design, 6thEdition, Cengage Learning (2017). Additional references supporting the course 2. T.K. Nagsarkar and M.S. Sukhija, Power Systems Analysis, 2th Edition, Oxford Press (2016) 3. J. Duncan Glover, Mulukutla S. Sarma, and Thomas Overbye, Power Systems Analysis and Design, SI 5thEdition, Cengage Learning (2012) 4. Theodore Wildi, Electrical Machines, Drives, and Power Systems, 6th Edition, Pearson Prentice Hall (2006) 5. Alexandra von Meier, Electric Power Systems: A Conceptual Introduction, 1stEdition, John Wiley & Sons (2006) 6. Hadi Saadat, Power System Analysis, McGraw Hill (2004)

1.	Name of Course :	ELECTRICAL ENERGY UTILISATION
	Course Code :	BTEE3633
2.	Synopsis :	This course is to introduce electric power utilisation and installation design for industrial, commercial and domestic consumers. The topic include electric drive, illumination, electric heating, electric welding, electrolytic processes, electric traction and electrical circuits used in refrigeration and air conditioning and water coolers.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Develop solutions for various electrical applications in the field of drives, traction, illumination, heating, welding, electrolytic and refrigerating processes. (C4,PLO3)
	CLO2	Investigate the wiring circuits and protection schemes for various types of electrical installation. (C4, PLO4)
	CLO3	Examine the social and environmental impact of various electrical energy utilization applications. (C4, PLO7)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1			✓											
CLO 2				✓										
CLO 3							✓							

7

Course Content Outline
Advantages of electric drives, characteristics of different mechanical loads, types of motors used in electric drive, electric braking, methods of power transfer by direct coupling by using devices like belt drive, gears, selection of drive for applications.
Nature of light, law of illumination, different type of lamps, construction and working of incandescent and discharge lamps, calculation of light points for interior illumination, main requirement of proper lighting.
Advantages of electric heating and heating methods, design of resistance heating elements. Advantages of welding, welding method, principles or resistance welding and arc production, introduction to TIG, MIG welding.
Needs of electro-deposition, law of electrolysis, process of electro deposition, equipment and accessories for electroplating, principles of galvanizing, anodising, electroplating on non-conducting materials, manufacturing of chemicals by electrolytic process and electrolysis process.
Principles of air conditioning, vapour pressure, refrigeration cycle, eco friendly refrigerants, circuits used in refrigerator, air conditioner and water cooler.
Advantages of electric traction, different systems of electric traction, different accessories for track electrification, electric block diagram of an electric locomotive, types of motors used for electric traction.

8	References (include required and further readings, and should be the most current)	1. C. L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, 3rd edition, electronic version, (2016). 2. Er. Tarlok Singh, Utilization of Electrical Energy (Including Electric Drives and Electric Traction), 2nd edition, S.K. Kataria & Sons, (2018). 3. Patrick, Dale R, Electrical Power Systems Technology, 4th Edition, Gistrup, (2021). 4. N. V. Suryanarayana, Utilization of Electric Power: Including Electric Drives and Electric Traction, Wiley Eastern, (2015).

1.	Name of Course :	COMMUNICATION SYSTEMS PRINCIPLES
	Course Code :	BTEE3013
2.	Synopsis :	This course presents the fundamental concepts in communication systems such as telephone, radio, and wireless devices.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BGEC3314

5 Course Learning Outcomes (CLO) :

CLO1	explain the building blocks and working principles of analogue and digital communication system. (C4, PLO1)
CLO2	apply suitable modulation schemes and transmission techniques of analogue and digital communication system for various applications. (C4, PLO2)
CLO3	investigate suitable techniques to be used in communication systems using computer aided analysis tool. (C5, PLO4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3				✓										

7

Course Content Outline

Intoduction to Communication Systems and Recap on fundamental signal processing theory and concepts required for this course.

Analgoue Communication
Theory and Concepts of Amplitude Modulation, Frequency Modulation, Pulse Modulation

Analgoue Communication
Applications of Amplitude Modulation, Frequency Modulation, Pulse Modulation

Digital Communication
Theory and Concepts of PCM, baseband data transmission, ASK, PSK, FSK, M-ary modulation, information theory and coding

Digital Communication
Applications of PCM, baseband data transmission, ASK, PSK, FSK, M-ary modulation

Investigate the performance the analogue and digital communication techniques in various applications using computer aided analysis tool.

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. D.K. Mynbaev and Scheiner L.L, Essentials of Modern Communications, Wiley, 2020. 2. B. P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 5th Edition, Oxford University Press, 2018 Additional references supporting the course 1. Ziemer, Rodger and William H. Tranter, Principles of Communications: System Modulation and Noise, 7th Edition, Wiley, 2015. 2. V. Chandra Sekar, Communication systems, Oxford University Press, 2013.

1.	Name of Course :	ARTIFICIAL INTELLIGENCE
	Course Code :	BTEH4413
2.	Synopsis :	This course covers the fundamentals of artificial intelligence that will involve the design and implementation of intelligent systems that perform useful tasks with some degree of autonomy. Upon successful completion of the course, students will be able to design and implement key components of intelligent systems. Objectives: This introductory course in Artificial Intelligence will cover the basic elements of modern AI.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Explain the fundamental principles of basic AI (C4), (PO1)
	CLO2	Explain how these basic AI concepts may be applied in the context of intelligent systems (C3), (PO2)
	CLO3	Evaluate intelligent systems based on basic AI algorithms (C5), (PO3).
	CLO4	Develop simple intelligent systems (P3), (PO5).

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3			✓											
CLO 4					✓									

7

Course Content Outline

Introduction to Artificial Intelligence
- introduction, motivations, history of AI, from the 'Dark Ages' to knowledge-based systems, applications

Problem-solving through Search
- what is search, heuristics, blind search vs informed search,depth first search, breadth-first search, bidirectional search, depth-limited search, greedy search, A* search, well known search problems

Knowledge Representation and Reasoning
- what is knowledge, rules as a knowledge representation technique, structure of a rule-based expert system.

Representing and Reasoning with Uncertain Knowledge
- what is uncertainty, basic probability theory,Bayesian reasoning, bias of Bayesian method, certainty factors, evidential reasoning

Expert Systems
- characteristics of an expert system, forward chaining and backward chaining, conflict resolution

Introduction to neural networks
- how the brain works,the neuron as a simple computing element, definitions, different models

Single-layer Perceptron
- mathematical model, perceptron learning rule, limitations of the perceptron

MLP and Back-propagation algorithm
- introduction, mathematical model, multiple layered network, Hebbian learning

Recurrent networks
- what are recurrent nets, Hopfield neural networks: discrete, the Continuous Hopfield Net, applications of Hopfield Nets.

	Introduction to Deep Learning and the convolutional neural net (CNN) - motivations, convolution process, max-pooling, and flattening	
	Fuzzy logic - introduction to fuzzy logic, history, motivations, fuzzy sets, linguistic variables and hedges, operations of fuzzy sets, fuzzy rules	
	Fuzzification and defuzzification methods - developing a fuzzy model, introduction to defuzzification, computing the centre-of-gravity for defuzzification	
	Fuzzy Inference system - Mamdani fuzzy inference, Sugeno fuzzy inference, which is better, Mamdani or Sugeno	
	Introduction to Swarm Intelligence & Support Vector Machines - what is Swarm Intelligcnce, some common SI models, theoretical foundations of Support Vector machines, what are Support Vectors.	
8	References (include required and further readings, and should be the most current)	Main references supporting the course 1.Wolfgang Ertel (2017), Introduction to Artificial Intelligence (Second Edition), Springer. 2.Stuart J. Russell and Peter Norvig (2016), Artificial Intelligence: A modern approach (3rd Edition), Pearson. 3.Negnevitsky, Michael (2005), Artificial Intelligence: A Guide to Intelligent Systems, Edison Wesley. Additional references supporting the course 4.Bather, J. Decision Theory: An Introduction to Dynamic Programming and Sequential Decisions. New York: Wiley (2000). 5.Satish Kumar (2005), Neural Networks: A Classroom Approach, McGraw Hill. 6.Ahmad M. Ibrahim (2004), Fuzzy logic for embedded systems applications, Elsevier 7.An Introduction To Support Vector Machines (and other kernel-based learning methods), N. Cristianini and J. Shawe-Taylor, Cambridge University Press, 2000 ISBN: 0 521 78019 5 8.Kernel Methods for Pattern Analysis,John Shawe-Taylor & Nello Cristianini, Cambridge University Press, 2004. 9.Kennedy, J. and Eberhart, R., “Particle swarm optimization”, Proceedings of the IEEE International Conference on Neural Networks, Perth, Western Australia, 27 November-1 December 1995, volume 4, pages 1942–1948 10.Swarm Intelligence: From Natural to Artificial Systems, Eric Bomabeau, Marco Dorigo and Guy Theraulaz, Oxford University Press (1999)

1.	Name of Course :	INDUSTRIAL TRAINING
	Course Code :	BTEE3905
2.	Synopsis :	This course involves 10 to 12 weeks attachment in the industry which will expose students to the actual working environment where students will be treated as part of the workforce and bound to the rules and regulations of the organization. In general, the aim of industrial training is to give exposure, experience and professional skills to various aspects of engineering disciplines in related industries. The students are also expected to be familiarized with efficient, accountable and ethical conduct as they will be supervised directly under the company's personnel.
3	Credit Value :	5
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Apply relevant engineering knowledge in accordance to industry practice. (C4)
	CLO2	Participate in industrial activities within resources given. (A3)
	CLO3	Demonstrate good attitude and ethics in accordance with professional engineering practice. (A3)
	CLO4	Demonstrate competency in communication skills at workplace. (A3)
	CLO5	Demonstrate the ability to work effectively in a workgroup. (A3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2						✓								
CLO 3								✓						
CLO 4									✓					
CLO 5										✓				

7

Course Content Outline

Pre-commencement briefings to students.

Students will participate in daily engineering activities and processes of the organisation such as production, design, maintenance, service, installation, collecting and analysis of data, coordinating group activities, attending meetings and discussions, etc.

8	References (include required and further readings, and should be the most current)	Main References 1. E. Kevin Eklloway, Lori Francis, Bernadette Gatien, (2017) Management of occupational health and safety, 7th Edition, Toronto, Nelson 2. Charles E Harris, Jr., (2019) Engineering Ethics: Concepts and cases, 6th Edition, Boston, Cengage Learning Additional References 1. Charles D Reese, (2016) Occupational health and safety management: a practical approach, 3rd Edition, CRC Press

1.	Name of Course :	PROJECT I
	Course Code :	BGEE4022
2.	Synopsis :	Rationale for the inclusion of the course in the programme This course provides students with the opportunity to demonstrate knowledge of a specialized field that is essential for a career in research and development. Objectives: To develop techniques in the literature review and information processing.
3	Credit Value :	2
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Develop objective(s) of the research through systematic research of problem statement
	CLO2	Conduct literature review and theoretical study required for the research
	CLO3	Communicate the findings of the research in the form of proposal.
	CLO4	Present the proposal in oral presentation.
	CLO5	Demonstrate professionalism in conducting research.

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2											✓			
CLO 3									✓					
CLO 4									✓					
CLO 5						✓								

7

Course Content Outline

General briefing on research methodology
? Overview of research
? Guideline on Research

Lectures on literature review
? Overview of literature review.
? Library resource search.
? Resource organization.

Lectures on Report Writing
? Proposal Writing
1) Research Background
2) Problem Statement
3) Research Objectives

Literature review, research work, meeting supervisor

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Ranjit Kumar (2011), Research Methodology: a step-by-step guide for beginners, 3rd Edition, Sage Publications 2. Chua Yan Piaw (2012), Mastering Research Methods, McGraw Hill. 3. Leedy, P. D. and Ormrod, J. E. (2012). Practical Research: Planning and Design. 10th Edition Upper Saddle River, NJ: Pearson Prentice-Hall. Additional references supporting the course 1. Fink, A. (2009), Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications. 2. Leedy, P.D. and Ormrod, J.E. (2012) Practical Research: Planning and Design, 10th Edition, Prentice Hall. 3. Bell, J (2010), Doing Your Research Project: a guide for first-time researches in education, health and social science, 5th Edition, Open University Press 4. Silverman, D (2009), Doing Qualitative Research, 3rd Edition, Sage Publications 5. Weinberg SL & Abramowitz SK (2008), Data Analysis for the Behavioural Sciences using SPSS, 2nd Edition, Cambridge University Press

1.	Name of Course :	Data Engineering and Analytics
	Course Code :	BGEE4183
2.	Synopsis :	This course provides students with advanced knowledge of deep learning and data analytics in the domain of engineering. This course covers technologies and methodologies necessary for inferring useful information and performing pattern recognition from raw, incomplete, and corrupted data that is present in real-life engineering applications.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEH4413
5	Course Learning Outcomes (CLO) :	
	CLO1	Examine models for supervised, unsupervised inference from data (C4)
	CLO2	Design efficient deep learning algorithms on a computer. (C5)
	CLO3	Design test procedures to evaluate a deep learning models (C5)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1			✓											
CLO 2					✓									
CLO 3			✓											

7

Course Content Outline

General pipeline of Machine Learning Systems
- Selection and Evaluation of Model
- Supervised system
- Classification (SVM, KNN, etc)
- Regression

-Unsupervised System
- Kmean clustering

Data Preparation and preprocessing
- Introduction to different data source
- Data Undestanding
- Data Normalization
- Data annotation/labeling
- Data Augmentation

Conventional Feature Engineering
- Feature Extraction from images using different approaches.
- Feature optimization
- Classification using conventional classifier
- Result validation and performance metrics (F1 score, confusion matrix, accuracy, etc)

Practical: Dataset preparation using machine learning toolbox. Feature extraction using opencv and other approaches.

	Deep learning- Basic (Part 1) - Shallow neural network/Fully connected layer and activation functions - Gradient descent - Convolution - Introduction to images and computer vision. - Deep learning layers. - Convolutional Layers - Maxpooling/Average pooling layers - Dense Layers (FCN) -Data import and one hot encoding - Dropout layers - Regularizations - Batch normalization - Loss function and weights	
	Deep learning - Basic (Part 2) - Overfitting and underfitting - Hyperparameters tuning - Bias-variance tradeoff - save weights and models	
	Introduction to different deep learning approaches for sequential data - Le Net - Alexnet - VGG16 and VGG19 - RESNET - Inception net V1, V2, V3 - Densenet	
	Transfer Learning - Classifying objects using different pre-trained network with weights from Imagenet - Freeze and unfreeze layers for training purpose. Practical: Obtain different pre-trained network from latest framework and classifying object	
	1)Deep Generative Models: Generative Adversarial Network (GANS) 2) Integration of trained model with different hardware in real-life application. - Object detection/classification/tracking etc. Practical:Integration of DL with hardware	
8	References (include required and further readings, and should be the most current)	Main: 1) Muller, Andreas C., and Sarah Guido. Introduction to machine learning with Python: a guide for data scientists. O'Reilly Media, 2017. 2) Chollet, Francois. Deep Learning with Python and Keras: The practical guide from the developer of the Keras library . MITP-Verlags GmbH & Co. KG, 2018. 3) Nelli, Fabio. Python data analytics: with pandas, numpy, and matplotlib. Apress, 2018.

1.	Name of Course :	RENEWABLE ENERGY
	Course Code :	BGEE4723
2.	Synopsis :	The course covers the types, technologies, development and prospects of renewable energy sources and the feasibility of the renewable energy sources in supplementing or replacing our fast depleting energy sources.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Explain the specific concept and theory with regards to renewable energies. (C4)
	CLO2	Analyse the problems associated with various types of renewable energy sources. (C4)
	CLO3	Determine the appropriate application of different renewable energy technologies in meeting specific energy needs. (C4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3							✓							

7

Course Content Outline

Introduction to Energy
- General Considerations.
- A Digression on the Necessity of a Finite World Population.

Electricity Generation and Transmission
- Electricity.
- Consumption of Electrical Energy: Projections and Exponential Growth.

Thermal aspects of Energy Generation
- Atoms and Chemical Energy.
- The Efficiency of Energy Generation and Thermodynamics.
- Production and Distribution of Electricity.
- Conservation: An Important Energy Source

Role of renewable energy
Energy sustainability and environmental considerations in use of renewable energy.

Solar energy and associated technologies
Broad outline of solar energy usage, solar energy intensity and methods of solar energy collection, solar cell calculation, main industrial technologies in solar energy utilisation, future development and prospects.

Wind energy
Utilisation of wind energy, associated technologies, future developments and prospects.

Hydro electric energy
Utilisation of hydro electric power, associated technologies, problems, future developments and prospects.

Bio-fuels
Utilisation of bio-fuels, associated technologies, viability, future developments and prospects.

Wave and tidal energy and other renewable energy sources
Utilisation of wave and tidal energy, geo-thermal energy, feasibility, prospects.

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Dunlap, Richard A. (2019) Sustainable energy, Cengage, Boston, MA 2. Bhatia, S. C. (2018) Textbook of renewable energy, Woodhead Publishing India Pvt Ltd, New Delhi, India. 3. Robert Ehrlich, Harold A. Geller. (2018) Renewable Energy: A First Course (2nd Ed.) CRC Press, Boca Raton, FL Additional references supporting the course 1. Gary Goodstal (2013) Electrical theory for renewable energy, Clifton Park, NY: Delmar/Cengage Learning. 2. S. A. Abbasi, Naseema Abbasi (2001, Printing 2006) Renewable energy sources and their environmental impact, New Delhi: Prentice-Hall of India.

1.	Name of Course :	PROJECT II
	Course Code :	BGEE4044
2.	Synopsis :	This course covers project planning, literature review, project management and implementation, technical writing and oral presentation.
3	Credit Value :	4
4	Prerequisite/co-requisite: (if any)	BGEE4022
5	Course Learning Outcomes (CLO) :	
	CLO1	Develop objective(s) of the research through systematic research of problem statement
	CLO2	Conduct literature review and theoretical study required for the research
	CLO3	Communicate the findings of the research in the form of thesis.
	CLO4	Present the thesis in oral presentation
	CLO5	Evaluate in depth the most suitable methodology for data collection and to conduct the experimental study.
	CLO6	Analyse the data and findings of the research obtained through the theoretical and experimental study that leads to valid conclusion.
	CLO7	Demonstrate responsibilities in conducting research

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2											✓			
CLO 3										✓				
CLO 4										✓				
CLO 5			✓											
CLO 6				✓										
CLO 7						✓								

7

Course Content Outline

How to write a good thesis
1) Introduction
2) Literature review
3) Methodology

How to publish in good journal

Project implementation

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Leedy, P. D. and Ormrod, J. E. (2021). Practical Research: Planning and Design. 12th Edition Upper Saddle River, NJ: Pearson Prentice-Hall. 2. Ranjit Kumar (2011), Research Methodology: a step-by-step guide for beginners, 3rd Edition, Sage Publications 3. Chua Yan Piaw (2012), Mastering Research Methods, McGraw Hill. Additional references supporting the course 1. Fink, A. (2009), Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications. 2. Leedy, P.D. and Ormrod, J.E. (2012) Practical Research: Planning and Design, 10th Edition, Prentice Hall. 3. Bell, J (2010), Doing Your Research Project: a guide for first-time researches in education, health and social science, 5th Edition, Open University Press 4. Silverman, D (2009), Doing Qualitative Research, 3rd Edition, Sage Publications 5. Weinberg SL & Abramowitz SK (2008), Data Analysis for the Behavioural Sciences using SPSS, 2nd Edition, Cambridge University Press

1.	Name of Course :	FALSAFAH DAN ISU SEMASA
	Course Code :	MPU-31E3
2.	Synopsis :	Kursus ini merangkumi hubungan ilmu falsafah dengan Falsafah Pendidikan Kebangsaan dan Rukun Negara. Penggunaan falsafah sebagai alat untuk memurnikan budaya pemikiran dalam kehidupan melalui seni dan kaedah berfikir serta konsep insan. Topik utama dalam falsafah iaitu epistemologi, metafizik dan etika dibincangkan dalam konteks isu semasa. Penekanan diberi kepada falsafah sebagai asas bagi menjalin dialog antara budaya serta memupuk nilai sepunya .
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Menjelaskan isu semasa berlandaskan ilmu falsafah, Falsafah Pendidikan Kebangsaan dan Rukun Negara. (C3, PLO11)
	CLO2	Menerangkan isu semasa berdasarkan aliran pemikiran utama dalam pelbagai aliran falsafah. (A2, PLO9)
	CLO3	Menganalisis isu semasa melalui perspektif perbandingan falsafah sebagai asas bagi menjalinkan dialog antara budaya. (A4, PLO11)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1											✓			
CLO 2									✓					
CLO 3											✓			

7

Course Content Outline

Bab 1: Pengenalan
- Pengenalan Ilmu Falsafah
- Falsafah Pendidikan Kebangsaan
- Rukun Negara

Bab 2: Falsafah dalam Kehidupan
- Cabang-cabang Ilmu Falsafah
- Falsafah Teoretikal
- Falsafah Praktikal

Bab 3: Logik
- Peranan Logik dan Pencegahan Falasi (Kesalahan Berfikir)
- Deduksi dan Induksi

Bab 4: Konsep Insan (Psikologi dan Sosiologi)
- Asal usul Insan
- Hakikat dan Sifat Insan
- Potensi-potensi Insan

Bab 5: Metafizik
- Hubungan Insan dengan Alam
- Hubungan Insan dengan Tuhan

Bab 6: Epistemologi
- Perkembangan Epistemologi dan Kesan Terhadap Kehidupan
- Pelbagai Kaedah dan Sumber Perolehan Ilmu
- Teori-teori tentang Kebenaran

Bab 7: Ideologi dan Isu Semasa
- Cabaran Ideologi Relativisme Pascamoden
- Fenomena dan Manifestasi Relativisme Pascamoden
- Implikasi Relativisme Pascamoden dalam Kehidupan

	Bab 8: Dekolonisasi - Kesan Dualisme Cartesian, Antroposentrisme, Insan Egologikal - Dekolonisasi Dualisme Cartesian, Pemikiran dan Ilmu Antroposentrisme - Menjayakan Insan Bersepadu Sejahtera/	
	Bab 9: Kajian Kes Terpilih Falsafah dan Isu	
8	References (include required and further readings, and should be the most current)	1. Noor Hisham Md Nawi. (2021). Modul Falsafah dan Isu Semasa, Kota Bharu: Penerbit UMK 2. Nor Hanani Ismail, et al (ed). (2021). Falsafah dan Isu Semasa, Sintok: UUM Press 3. Dzulkifli Abdul Razak, Rosnani Hashim. (2020). Pentafsiran Baharu Falsafah Pendidikan Kebangsaan dan Pelaksanaannya Pasca 2020, Kuala Lumpur: IIUM Press

1.	Name of Course :	DESIGN OF CONTROL SYSTEMS
	Course Code :	BTMR3423
2.	Synopsis :	This course covers frequency domain analysis, compensator design and discrete systems analysis and design.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTGE3413
5	Course Learning Outcomes (CLO) :	
	CLO1	analyse the performance of LTI systems in frequency domain (C4)
	CLO2	implement feedback compensation methods for continuous, digital and state-space systems (C6)
	CLO3	perform investigation on performance of the feedback compensator under varying system parameter(s). (C5)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2			✓											
CLO 3				✓										

7

Course Content Outline
Frequency Response Analysis (Nyquist, Bode, Nichols, Stability Criteria)
Compensation of Feedback Control Systems (Lead, Lag, Lead/Lag using root locus and Bode, PID)
Digital Control Systems(Sampled data system, Stability, Bilinear Transformation)
Design of State Feedback System (Full state feedback system and state observer design)

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Nise, N.S., Control Systems Engineering, 8th Edition, NY (2019) 2. Dorf, R.C. Robert H. Bishop, Modern Control Systems,12th Edition, Prentice Hall (2017) 3. Ogata, K, Modern Control Engineering, 5th Edition, Pearson (2010) Additional references supporting the course 1. Ogata, K, System Dynamics, 4th Edition, Pearson/Prentice Hall (2004) 2. Constantine H. Houpis, Stuart N. Sheldon, Linear control system analysis and design with MATLAB, 6th Ed, CRC Press (2014)

1.	Name of Course :	COMPUTER ARCHITECTURE
	Course Code :	BTEE3213
2.	Synopsis :	This course aims to expose students to the architecture and characteristics of modern-day computer systems.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEC2233
5	Course Learning Outcomes (CLO) :	
	CLO1	Explain how memories are organized into hierarchy in modern computer system. (C4)
	CLO2	Analyse the implementation and performance of different instruction sets when designing CPU. (C4)
	CLO3	Analyse computer performance by exploiting instruction level parallelism. (C4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3			✓											

7

Course Content Outline

Fundamentals of Computer Design
Task of a computer designer, Technology Trend,Cost, Performance evaluation, Quantitative Principles of computer design

- Performance evaluation
- Quantitative Principles of computer design

Instruction Set Principles and Examples
Classification of ISAs, Memory Addressing, Addressing Modes, Types of operations, Type and size of operands, Types of operations, Type and size of operands, Encode of instruction set

Pipelining
Concept of instruction pipeline, Basic pipeline for MIPS, Implementations

Pipelining and Instruction-Level Parallelism
Pipeline hazards , Instruction-level parallelism, Hardware Approaches, Software Approaches

Memory Hierarchy Design
Cache principles, Elements of cache design, Effect of cache on performance, Improving cache performance, Examples of cache in Multiprocessor system, Main memory and organization, DRAM and SRAM, Improved DRAM, ROM and Flash, Virtual Memory, Paging

Storage System
Magnetic disk, Optical memory, Magnetic tape, RAID, Buses-connecting I/O to CPU/Memory, I/O Performance

Discussion of the Intel x86 architecture
Real-mode software architecture, Protected-mode software architecture, Hardware architecture, Memory Interfacing, I/O Interfacing, Interrupt and exception processing

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Hennessy and Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufman, 6th Edition (2019) 2. William Stallings, Computer organization and architecture : designing for performance, 10th Edition, Pearson (2016)

1.	Name of Course :	MICROELECTRONICS
	Course Code :	BTEE4013
2.	Synopsis :	Microelectronics is an essential course for the understanding of integrated circuit and semiconductor manufacturing. This course will also equip students with knowledge of solid state electronics.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	explain the theory of semiconductor solid state and quantum mechanics. (C4, PLO1)
	CLO2	analyse the solid state operation and electrical properties of semiconductor devices (C4,PLO2)
	CLO3	design semiconductor devices to comply with given IC technology file. (C6,PLO3)
	CLO4	design CMOS integrated circuits with CAD tools.(P3,PLO5)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3			✓											
CLO 4					✓									

7 **Course Content Outline**

Introduction to IC
-Basic IC fabrication process

Quantum Mechanics and Theory of Solids
- Introduction to quantum mechanics
- Energy quanta
- Wave-particle duality
- Uncertainty principle
- Energy states in atom
- Pauli exclusion principle
- Allowed and forbidden energy bands

Semiconductor in Equilibrium
- Charge carriers in semiconductors
- Dopant atoms and energy level
- Intrinsic and extrinsic semiconductor

Carrier Transport Phenomena
-Carrier drift

The pn Junction
-Basic structure of pn junction
-Zero applied bias
-Reverse applied bias
-Non-uniformly doped junction
- pn junction current

MOSFET
-The two-terminal MOS structure
-Capacitance-voltage characteristics
-MOSFET operation
-Frequency limitation
-Non-ideal effects

Semiconductor Devices
-Integrated circuits: CMOS

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Betty Anderson, Richard Anderson, Fundamentals of Semiconductor Devices, 2nd Edition, Mc Graw Hill Education (2018) 2. Donald A. Neamen, Semiconductor Physics and Devices: Basic Principles, 4th Edition, McGraw-Hill, 2012. *Out of print Additional references supporting the course 3. Manijeh Razeghi, Fundamentals of Solid State Engineering, 3rd Edition, Springer, 2010. 4. R. K. Puri, V. K. Babbar, Solid State Physics and Electronics, 3rd edition,New Delhi, S. Chand (1997). 5. S. M. Sze and Kwok K. Ng, Physics of Semiconductor Devices, John Wiley (2007). 6. Ben G. Streetman, Solid State Electronic Devices, 6th Edition, Prentice-Hall (2006)

1.	Name of Course :	HIGH VOLTAGE ENGINEERING
	Course Code :	BTEE4623
2.	Synopsis :	This course provides a good overview of conduction and breakdown in gases, liquid dialect, solid dialect, insulating materials. Method to generate and measure high voltages and currents. Overvoltage phenomenon and insulation in electrical power system. High voltage testing of electrical apparatus.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BGEE2614 ELECTRICAL POWER SYSTEMS OR ITS EQUIVALENT
5	Course Learning Outcomes (CLO) :	
	CLO1	Analyze high voltage/ current generation circuits, high voltage tests on insulator and measurement. (C4, PLO1)
	CLO2	Analyze the breakdown phenomenon in gases, liquids and solid insulators. (C4, PLO2)
	CLO3	Apply suitable electrical components for insulation coordination on high voltage and extra high voltage power system. (C5, PLO3)
	CLO4	Relate the impact of high voltage to the environment and human health. (C4, PLO6)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2		✓												
CLO 3			✓											
CLO 4						✓								

7

Course Content Outline
Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages.
Impact of high voltage to the environment and human health - protection against over voltages. International and Malaysia standards
Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics.
Generation of high DC, AC, impulse voltages and currents. Tripping and control of impulse generators. Measurement of high DC, AC, and impulse voltages and currents. Cathode-ray oscillographs for impulse voltage and current measurements. High voltage testing of electrical power apparatus – Power frequency, impulse voltage and DC testing.
Principles of insulation coordination on high voltage and extra high voltage power system. – Basic Lightning Insulation Level and Basic Switching Insulation Level.

8	References (include required and further readings, and should be the most current)	"1. M. S. Naidu and V. Kamaraju, High Voltage Engineering, 5th edition, McGraw Hill Education (2013). 2.. Peter Mackintosh, High voltage engineering, Larsen & Keller (2018). 3. C. L. Wadhwa, High Voltage Engineering, 2nd edition, New Age International (P) Ltd., Publishers (2007). "

1.	Name of Course :	EMBEDDED SYSTEMS
	Course Code :	BTEC4213
2.	Synopsis :	This course is focused on the software aspects of modern 32-bit microcontroller technology. The course is based on a top-down analysis of the job functions of a typical microcontroller engineer, and the tasks and knowledge of microcontroller technology that would be required to successfully perform that job. Subject area includes processor architecture, software development, optimization, debug, system start-up and implementation.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEH1223
5	Course Learning Outcomes (CLO) :	
	CLO1	Analyse and examine the hardware architecture and software model of modern 32-bit microcontrollers for the development of embedded systems. (C4)
	CLO2	Develop microcontroller applications for the solution of complex engineering problems that require automatic control and/or communication. (C6)
	CLO3	Display proficiency in the utilization of modern platform-based embedded system development tools. (P4)
	CLO4	Demonstrate autonomous acquisition of relevant know-how from technical literature/sources to utilize current embedded systems technology. (A3)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2			✓											
CLO 3					✓									
CLO 4											✓			

7

Course Content Outline

Introduction:
Embedded systems, microprocessors and microcontrollers, development processes for embedded systems, modern 32-bit microcontroller technology.

Architecture:
Exception model (core exceptions, interrupt handling), memory protection unit, CPU registers, modes and stacks, instruction set, system timer, memory model, and power modes.

Software Development & Optimization:
Standards, barrier usage scenario, determinism, fault tolerance, code generation, image generation, real-time operating system (kernel, scheduler, thread management, time management, interthread communication, interrupt handling), and code generation.

Software Debug, System Start-up & Implementation:
Standard debug techniques, standard debug facilities, memory setup, system initialization, bit-banding, system timer options, and differences across cores.

Emerging Technologies:
Introduction to Internet of Things (IoT) and enabling technologies, mobile and cloud computing.

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. Ariel Lutenberg, Pablo Gomez, Eric Pernia (2022), A Beginner's Guide to Designing Embedded System Applications on Arm Cortex-M Microcontrollers, Cambridge: ARM Education Media. 2. Alexander G. Dean (2021), Embedded systems fundamentals with ARM Cortex-M based microcontrollers: a practical approach, 2nd Edition, Cambridge: ARM Education Media. 3. Trevor Martin (2016), The Designer's Guide to the Cortex-M Processor Family, 2nd Edition, Oxford: Newnes, Elsevier. Additional references supporting the course 1. Yiu, Joseph (2015), The Definitive Guide to the ARM Cortex-M0 and Cortex-M0+ Processors, 2nd Edition, Oxford: Newnes, Elsevier. 2. Yiu, Joseph (2014), The Definitive Guide to the ARM Cortex-M3 and Cortex-M4 Processors, 3rd Edition, Oxford: Newnes, Elsevier.

1.	Name of Course :	POWER TRANSMISSION AND DISTRIBUTION
	Course Code :	BTEE4613
2.	Synopsis :	The course covers planning, design, construction and operation in Medium (MV) and Low voltage (LV) Distribution Systems Network. The students will be introduced to the fundamental theory, construction and operation of various major components used in MV and LV Distribution System. Overview of safety procedures will also be introduced. This subject is to provide students with the understanding of components of industrial utility power systems, voltage levels, types of transmission systems and their components, and different electrical distribution systems.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEE3513
5	Course Learning Outcomes (CLO) :	
	CLO1	Identify different parts and function of electrical power transmission and distribution systems. (C4)
	CLO2	Design transmission and distribution schemes for electrical power systems. (C4)
	CLO3	Compare and justify safety standards for transmission and distribution electric power system. (C6)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1				✓										
CLO 2			✓											
CLO 3								✓						

7

Course Content Outline

Introduction
Structure of electric power system, types of AC and DC distributors, HVDC and EHV AC transmission

Transmission line parameters
Parameters of single and three phase transmission lines with single and double circuits: Resistance, inductance and capacitance of solid, stranded and bundled conductors: Symmetrical and unsymmetrical spacing and transposition, application of self and mutual GMD, skin and proximity effects, interference with neighbouring communication circuits. Typical configuration, conductor types and electrical parameters of 400, 220, 110, 66 and 33 kV lines

Modelling and performance of transmissions lines Classification of lines:
Short line, medium line and long line, equivalent circuits, attenuation constant, phase constant, surge impedance,transmission efficiency and voltage regulation, real and reactive power flow in lines: surge-impedance loading, shunt and series compensation, Ferranti effect and corona loss

Insulators and cables
Insulators: Types, voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Introduction, Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3- core belted cable, D.C cables

Mechanical design of lines and grounding
Mechanical design of transmission line, sag and tension calculations for different weather conditions,Methods of grounding –,Peterson coil ,Substation layout-Tower

8	References (include required and further readings, and should be the most current)	Main references supporting the course 1. K. L. Ratnakar, Electrical Power Transmission and Distribution, New Academic Science (2018) 2. Turan Gonen, Electric power distribution engineering, 3rd edition, CRC Press, (2014). 3. Turan Gonen, Electrical power transmission system engineering: analysis and design, 3rd edition, CRC Press, (2014). Additional references supporting the course 1. L. L. Grigsby, Electric power generation, transmission, and distribution, 3rd edition, CRC Press, (2012).

1.	Name of Course :	COMPUTER VISION
	Course Code :	BGEE4223
2.	Synopsis :	This course will provide an overview of the fundamentals of computer vision, multiple view geometry, image segmentation, feature extraction and matching, motion estimation and object tracking, image classification and scene understanding. The basic approach and applications of depth recovery in stereo vision, camera calibration, image stitching, feature recognition, object tracking and others will be introduced and discussed in this course. Fundamental mathematics and theory will be learned and practiced in this course.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEH4413 ARTIFICIAL INTELLIGENCE
5	Course Learning Outcomes (CLO) :	
	CLO1	Elucidate theoretical aspect of computing with low-level image formation and camera calibration. (C4)
	CLO2	Combine concepts of 2D and 3D Computer Vision with methods used for image registration and feature matching. (C5)
	CLO3	Design setups leading to object/scene/motion understanding. (P6)
	CLO4	Review the current computer vision technology in various real-world applications (A4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2			✓											
CLO 3					✓									
CLO 4											✓			

7

Course Content Outline

Introduction to Computer Vision
-Background, requirement and issues, human vision and computer vision
- Introduction of 2D Image.
  - Pixels, lines, boundaries gradient changes, etc

"Image Formation.
2.1 Camera Calibration
  2.1.1 Intrinsic Parameters
  2.1.2 Extrinsic Parameters
  2.1.3 Rotation and Translation matrix
  2.1.4 Camera Coordinates, Pixel Coordinates and Real World Coordinates
2.2 Image Distortion Correction
2.3 Position Estimation

Multiple View Geometry I
3.1 Feature Points Extraction
  3.1.1 Harris Corner Detection
  3.1.2 Hessian Matrix
  3.1.3 Shi-Tomasi Point Detection
  3.1.4 SIFT / SURF
  3.1.5 FAST Feature
  3.1.6 BRIEF
  3.1.7 ORB

Multiple View Geometry II
4.1 Epipolar Points, Line, and Plane
4.2 Fundamental Matrix, Homography Matrix and Essential Matrix
4.3 Stero Vision and Depth Calculation
4.4 Image stitching and warping
4.4 Depth Map Estimation
4.5 3D Object Reconstruction

Lab 2:

Image Segmentation
5.1 Various method of Foreground/Background segmentation
- 5.1.1 Background Subtraction
- 5.1.2 K-Mean Clustering
- 5.1.3 Motion based Segmentation
- 5.1.4 Histogram Based Segmentation (OTSU)

Various Feature Extraction and Recognition I
6.1 Edge Detection
6.2 Texture based Feature Extraction
6.3 Contour and shape
6.4 Blob Extraction
6.5 Template Matching
6.6 Hough Transform
6.7 Haar Transform
6.8 Morphological Operation

Various Feature Extraction and Recognition II
7.1 Combination of low-level features and machine learning classification using different classifiiers
- 7.1.0 Training and Testing
- 7.1.1 Supervised and un-supervised learing
- 7.1.2 Feature Descriptor generation
- 7.1.3 Facial Recognition
- 7.1.4 Fingerprint recognition
- 7.1.5 Defect Recognition

7.2 Object Recognition using Deep Learning

Lab 4:
- Integrating computer vision based module in hardware.

Object detection, Tracking and Motion analysis
8.1 Object detection and tracking
- 8.1.1 Tracking using Kalman Filter
- 8.1.2 Tracking using optical flow
- 8.1.3 Tracking using particle filter
- 8.1.4 Tracking using Deep Learning

Using Computer Vision in different real-world applications
9.1 Security
9.2 Biomedical imaging
9.3 Industry application

8	References (include required and further readings, and should be the most current)	1. Hartley, R., & Zisserman, A. (2004). Multiple View Geometry in Computer Vision (2nd ed.). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511811685 2. Spizhevoi, Aleksei, and Aleksandr Rybnikov. OpenCV 3 Computer Vision with Python Cookbook : Leverage the power of OpenCV 3 and Python to build computer vision applications, Packt Publishing, Limited, 2018. ProQuest Ebook Central, https://ebookcentral-proquest-com.tarcez.tarc.edu.my/lib/tarc-ebooks/detail.action?docID=5332144. 3. Fundamentals of Computer Vision 1st Edition, Cambridge University Press; 1st edition (November 7, 2017)

1.	Name of Course :	MULTIMEDIA TECHNOLOGY AND APPLICATIONS
	Course Code :	BTEC4313
2.	Synopsis :	The course emphasises practical applications of multimedia signal processing, specifically image, audio and video design and implementation issues. Intutive explanations and appropriate examples are used to develop a fundamental understanding of theory, laying a firm foundation for the reader to pursue the matter further.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	Nil
5	Course Learning Outcomes (CLO) :	
	CLO1	Assess the key technologies in multimedia systems. (C5)
	CLO2	Propose appropriate methods to manipulate image, video, and audio signals given specific requirements. (C6)
	CLO3	Evaluate multimedia system in terms of storage requirement, advantages and disadvantages. (C5)
	CLO4	Utilize computer aided software tools to process digital multimedia signals. (P4)

6

Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1	✓													
CLO 2			✓											
CLO 3				✓										
CLO 4					✓									

7

Course Content Outline

Introduction to multimedia: multimedia systems; components and technology; multimedia software tools; multimedia data representation.

Image processing: graphics and image data representation; colour in image and video; image manipulation techniques; image transformations; morphological operations; image compression standard.

Digital audio processing: digital audio ADC/DAC; audio compression principles; audio compression standard.

Video processing: analogue television broadcast and digital video; video compression principles; video compression standard.

Communications and networking multimedia (multimedia over wireless and mobile networks): characteristics of wireless channels; wireless networking technologies; multimedia over wireless channels.

Human-centric interactive multimedia (augmented reality and virtual reality): defining augmented reality and virtual reality; workflow of augmented reality; early foundational systems and applications; modern augmented reality systems and applications.

Applied multimedia (sensor and digital twin technologies): sensor technology (basics of microtechnology; wafer manufacturing; oxidation; lithography; etching; deposition and ion implant; metal wiring; electrical die sorting; packaging) and digital twin technology (introduction to digital twin; concept of digital twin; applied digital twin).

8	References (include required and further readings, and should be the most current)	Main references: 1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of multimedia, Springer, 3rd Edition (2021). 2. John C.Russ, F. Brent Neal, The image processing handbook, CRC Press, 7th Edition (2017). 3. Walter Lang, Sensors and measurement systems, River Publishers, 2nd Edition (2021). 4. Manisha Vohra, Digital Twin Technology: Fundamentals and Applications, Wiley, 1st Edition (2022). Add-on references 1. Yun-Qing Shi, Huifang Sun, Image and video compression for multimedia engineering: Fundamentals, Algorithms and Standards, CRC Press, 3rd Edition (2019). 2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education Limited, 4th Edition (2018). 3. Ben Gold, Nelson Morgan, Dan Ellis, Speech & Audio Signal Processing: Processing & Perception of Speech and Music, Wiley-Interscience, 2nd Edition (2011). 4. Gopal Chaudhary, Manju Khari, Mohamed Elhoseny, Digital Twin Technology, CRC Press, 1st Edition (2022).

1.	Name of Course :	POWER SYSTEM PROTECTION
	Course Code :	BTEE4633
2.	Synopsis :	This course is focused on teaching the fundamental concepts and the related design aspects of protective relay schemes. A protection scheme in a power system is designed to continuously monitor the power system to ensure maximum continuity of electrical supply with minimum damage to life, equipment, and property.This course will equip students with in-depth knowledge of power system protection for further studies in related areas.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEE3513
5	Course Learning Outcomes (CLO) :	
	CLO1	Elaborate the principles, operation and application of power protection schemes. (C4)
	CLO2	Distinguish the function of numerous types of relays and circuit breakers. (C4)
	CLO3	Design protection schemes for numerous power system components. (C5)
	CLO4	Investigate lab based protection schemes using relays and circuit breakers. (C4)

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Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1		✓												
CLO 2	✓													
CLO 3			✓											
CLO 4				✓										

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Course Content Outline
Introduction to power system protection
Protective device characteristics
Overcurrent protection of transmission lines
Differential protection
Transformer protection
Busbar protection
Distance protection
Pilot protection
Generator protection
Induction motor protection

8	References (include required and further readings, and should be the most current)	"Main references supporting the course 1. Sunil S.Rao, Switchgear Protection And Power Systems, Khanna Publishers (2019) 2. Ravindra P. Singh, Switchgear and Power System Protection, John Wiley (2014) 3. J. Lewis Blackburn and Thomas J. Domin, Protective Relaying: Principles and Applications Four Edition, CRC Press (2014) Additional references supporting the course Bhuvanesh A. Oza, Nirmal-Kumar C. Nair, Rashesh P. Mehta and Vijay H. Makwana, Power System Protection and Switchgear, Tata McGraw Hill Education Private Limited (2011)

1.	Name of Course :	INTEGRATED CIRCUITS TECHNOLOGY
	Course Code :	BTEE4033
2.	Synopsis :	This course will focus exclusively on digital CMOS VLSI system design. Issues in mixed-signal mode will also be addressed. Systematic understanding, design and analysis of integrated circuits will be covered.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEE4013
5	Course Learning Outcomes (CLO) :	
	CLO1	design integrated circuit layout with appropriate design rules and techniques. (C6)
	CLO2	evaluate the performance of integrated circuit design for fabrication. (C5)
	CLO3	verify integrated circuit design for fabrication using CAD tools. (P4)

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Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1			✓											
CLO 2				✓										
CLO 3					✓									

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Course Content Outline
Introduction to VLSI design: A historical perspective, quality metrics of a digital design. CMOS Fabrication Process: CMOS technology, wafer formation, photolithography, well and channel formation, gate and source/drain formation, contacts and metallization
HSPICE Simulation: Motivation for circuit simulation, Introduction to HSPICE, advantages of Monte Carlo simulation Layout Design Rules: Design rule background, Micron design rules, design rule checking (DRC), Computer Aided Design (CAD) Issues
Layout Techniques for Complex Gates: Standard cell layout, Euler graph approach
Interconnect Wires, Static CMOS Inverter
Combintional Logic: Standard Cells, Circuit Families, Low Power CMOS , Sequential Logic
Layout Synthesis and optimization: Floorplanning, array layout techniques, FPGA , Power consumption: Strategies for low power design in VLSI design , Propagation delay

8	References (include required and further readings, and should be the most current)	"Main references supporting the course 1. N. H. Weste and D. Harris, CMOS VLSI Design: A Circuits and Systems Perspective, Addison-Wesley, 4th Edition (2011). *Out of print 2. R. Jacob Baker, CMOS: Circuit Design, Layout and Simulation, IEEE Press Wiley, 4th Edition (2019) Additional references supporting the course 1. M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits, Pearson (2016). 2. Nicholas L. Pappas, CMOS Circuit Design: Analog, Digital, IC layout, Electrical and Electronics Engineering Design Series (2014) 3. S. M. Kang, Y. Leblebici and C. Kim, CMOS Digital Integrated Circuits: Analysis & Design, McGraw-Hill Education, 4th Edition (2015).

1.	Name of Course :	POWER QUALITY
	Course Code :	BTEE4643
2.	Synopsis :	Students are introduced to power quality phenomena such as voltage sag/swell, distortions, unbalance, and flicker that occur in power systems. The course begins with terms and definitions associated with power quality, following with each phenomenon, that is, voltage sag/swell, transient overvoltage, harmonics, and flicker is presented and discussed in detail for students to understand the sources and impact of these occurrences on power system as well as typical mitigation techniques. Finally, students are introduced to power quality benchmarking, monitoring and assessment in regards to international standards. The objective of this subject is to provide students with the understanding of the various issues affecting power quality, their production, monitoring and suppression.
3	Credit Value :	3
4	Prerequisite/co-requisite: (if any)	BTEE3513
5	Course Learning Outcomes (CLO) :	
	CLO1	evaluate common power quality problems and recommend solutions.(C6)
	CLO2	evaluate the effect of problems associated with stray voltages, malfunctioning equipment and equipment operation on other equipment connected to the same supply.(C5)
	CLO3	evaluate reliability indices regarding power quality of a system based on case studies. (C5)

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Course Learning Outcomes (CLO)	Programme Learning Outcomes (PLO)													
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12		
CLO 1				✓										
CLO 2						✓								
CLO 3				✓										

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Course Content Outline

Introduction to power quality

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell – voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality.

Voltage sags and interruptions

Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

Overvoltages

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning

protection – shielding - line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

	Harmonics Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion -passive and active filters. IEEE and IEC standards.	
	Power Quality Monitoring Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modelling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – Quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.	
8	References (include required and further readings, and should be the most current)	1. P. Sanjeevikumar, C. Sharmeela, Jens Bo Holm-Nielsen, P. Sivaraman, Power Quality in Modern Power Systems, ProQuest, (2021). 2. J. Duncan Glover, Thomas J. Overbye, Mulukutla S. Sarma, Power System Analysis & Design, 6th edition, Cengage Learning, (2017). 3. Patricio Salmeron Revuelta, Jaime Prieto Thomas, Salvador Perez Litran, Active Power Line Conditioners: Design, simulation and implementation for improving power quality, Academic Press, (2016). 4. Mohammad A. S. Masoum, Ewald F. Fuchs, Power Quality in Power Systems and Electrical Machines, Academic Press, (2015). 5. Roger C. Dugan, Mark F. McGranagham, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, 3rd edition, McGraw Hill, (2012). 6. Surajit Chattopadhyay, Madhuchhanda Mitra, Samarjit Sengupta, Electric Power Quality, 1st edition, Springer, (2011).