BENSON IDAHOSA UNIVERSITY

Core Curriculum & Minimum Academic Standards for the Nigerian University System (CCMAS)

Faculty of Engineering

Department of Mechanical Engineering

B.ENG. Mechanical Engineering

Student Handbook

2023-2028

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BENSON IDAHOSA UNIVERSITY

Mandate

The vision of Benson Idahosa University flows from its divine mandate which was God's spoken words to its founder, Archbishop B.A. Idahosa: to raise for Him Africa's first Charismatic Christian University. It was to be a centre of excellence where leaders would be raised to take God's name to places of prominence in Nigeria, Africa, and the world. His vision was to raise up an army of professional and academics who would go in Christ name to the ends of the world with the fire of the Holy Ghost to impart truth by precept and example.

Vision Statement

Benson Idahosa University aspires to be model for ***Academics, Professionals and Entrepreneurs, who will be effective disciples for Christ by excelling in their professional fields***. It will be distinguished by high performance in interdisciplinary research, addressing national and international problems, eliminating wrong behavioural patterns among students and becoming a storehouse of knowledge to be used for benefit of mankind on Christian ethical principles designed to change the nation and the continent by changing one student's life at a time.

Mission Statement

Benson Idahosa University is a private Christian University providing state-of-the-art undergraduate, postgraduate and professional education. We are committed to the mission of ***raising leaders for the nation, who are complete in spirit, mind and body, thus contributing to the production of high-level leadership and quality manpower for the nation and the world***. We perform these functions by judiciously utilising current information and communication technology, networking with similar institutions worldwide, putting people first in operations and emphasising Christian ethical values. The beneficiaries of the University's service are students, employers of labour, present and future generations, Nigeria and the global community.

Our Core Purpose

Change Nigeria

Our Core Values (TOP-TIAA)

Teamwork
Ownership Mentality
People Matter
Transparency & Integrity
Innovation
Accountability
Academic excellence with Godliness

LIST OF PRINCIPAL OFFICERS

S/N	NAME	QUALIFICATIONS	POSITION
1	Prof. Sam Guobadia	B. Sc. - (Economics) M. Sc. - (Economics) Ph. D - (Economics)	Vice Chancellor
2	Prof. Johnson Oyedeji	B.Sc. - Agric. M.Sc. - Animal Science Ph.D. - Animal production & Management.	Deputy Vice-Chancellor
3	Mr. Vinton Itoya	Dip. Lib. -Library Science. B. Lis. - Lib & Info. Science. M.Td. - Educational Management.	Registrar
4	Dr. Gladday Igweagbara	B. Sc. – Botany MBA - Accounting MPhil/Ph.D. – Accounting	Bursar
5	Dr. Mrs. Rosemary Odiachi	B. Sc. - Library Science M. Sc. - Library Science Ph. D. - Library Science	Librarian

LIST OF MECHANICAL ENGINEERING STAFF (TEACHING STAFF)

S/N	Name of Staff	Rank/Designation	Qualification, dates obtained and specialization, membership of professional association	Area of Specialty
1	Engr. Prof. D. I. Ikhu-omoregbe	Professor **Dean**	P*h.D.* Chemical Engineering (Birmingham, *1985)* M.Sc. Biochemical (Birmingham, 1982), B.Eng. Chemical Engineering (Benin, 1979) *MNSE*, *COREN*	Materials Science and Energy Technology
2	Engr. Dr. D.D. Olodu	Senior Lecturer **HOD**	PhD. (2017) Manufacturing Engineering, M.Eng (2013) Manufacturing Engineering, B.Tech (2005) Electro-Mechanical Engineering COREN (2018)	Design and Manufacture
3	Dr. S.A. Omotehinse	Lecturer I	PhD. (2021) Industrial Engineering, M.Eng (2010) Industrial Engineering, B.Eng. (2005) Production Engineering	Production/Industrial Engineering
4	Engr. O.N. Aibangbee	Lecturer I	M. Eng. (2002) Industrial Engineering, B. Eng. (1998) Mechanical Engineering. COREN (2009)	Composite materials and Process Optimization,
5	Engr. Dr. O. Oghoghorie	Lecturer I	PhD. (2023) Manufacturing Engineering, M. Eng. (2013) Industrial Engineering, B. Eng. (2009) Mechanical Engineering, COREN (2016).	Industrial Engineering
6	Engr. F.U. Osaghae	Lecturer I	M. Eng. (2014) Mechanical Engineering, B. Eng. (1984) Mechanical Engineering COREN (2015)	Design and Manufacture
7	Mr. G.O. Okagbare	Lecturer I	M. Eng. (2014) Mechanical Engineering, B.Eng. (2001) Mechanical Engineering	Design and Manufacture

LIST OF MECHANICAL ENGINEERING TECHNICAL STAFF STAFF

S/N	Name of Staff	Rank/Designation	Qualification, dates obtained	Area of Specialty/Duties
1	Engr. G. I. Onaghise	Chief Technologist	B.Eng (Mechanical), 2003, City and Guilds Part 1 & 2 Certificate (1970 and 1971.	Machine Operator and Lab Expert
2	Idemudia Uyi	Technologist II	B.Eng (Mechanical), 2014, Ambrose Ali University	Mechanical Engineering Laboratory Technologist
3	Ehioghae Destiny	Fitter Machinist	(Trade Test I, II, III)	Machine Operator
4	Umoru Friday	Confidential Secretary II	HND in Office Technology and Management (2022)	Secretary to HOD

B.ENG. MECHANICAL ENGINEERING

Overview

Mechanical engineering is the application of the principles of physics (namely of motion, energy, and force), mathematics, materials science and engineering problem-solving techniques to the design, analysis, manufacture, operation and maintenance of mechanical systems while ensuring competitive costing, safety, reliability and efficiency of such systems. The mechanical engineering discipline employs contemporary design tools such as computer-aided design (CAD), computer-aided manufacturing (CAM), and product lifecycle management tools to analyse and design a wide variety of systems.

This curriculum is designed in line with contemporary global trends in Mechanical Engineering education; emphasising development of materials, mass, momentum and energy balances leading to the geometric description of conservation laws of nature. These lead to several important constitutive models and multiphysics in special fields such as:

1. Linear and nonlinear mechanics Applied (solid) Mechanics (involving the analysis of the behaviour of solid bodies subjected to external loads, stresses and/or vibrations and using the information in the design and manufacture/construction of such bodies);
2. Fluid Mechanics (involving the analysis of the behaviour of liquids and gases and employing the knowledge in the design and development of machinery and systems that can and/or do influence that behaviour – pumps, fans, turbines, piping systems, et cetera);
3. Thermal Engineering [including Thermodynamics and Heat Transfer] (involving the analysis of the conversion of thermal energy into work and/or other forms of energy and thermal energy transport and employing this knowledge in the design and development of energy conversion devices and systems, e.g., power plants, engines, heating, ventilation & air conditioning (HVAC) systems, etc.);
4. Mechanical Design and Manufacturing Engineering (covering the full range of mechanical-based products and systems); arising from the above engineering sciences synthesized together into modern software solutions of the resulting complex equations that, added to 3D Solid models, simulation analysis and optimization produce useful design tools;
5. Industrial Engineering and Management Sciences.

Philosophy

The philosophy of the programme is to produce self-reliant and confident graduates who can bring their academic and practical backgrounds to bear on the problems of industry and the larger Nigerian society. The academic programme has been planned to challenge and encourage students towards developing ingenuity and originality in problem solving. The cornerstone of this is an early grounding in the basic engineering sciences and a strong emphasis on applied design in later years.

Objectives

The objectives of the undergraduate Mechanical Engineering programme are to prepare its graduates to:

1. actively engage in engineering practice or in other fields, such as education, science, business, public policy, politics or governance for sustainable development;
2. retain intellectual curiosity that will motivate them to pursue meaningful lifelong learning via graduate education in engineering or related fields, participation in professional development and/or industrial training courses, and/or obtain engineering certification;
3. develop successful careers as mechanical engineers and apply their mechanical engineering education to address the full range of technical and societal problems with professional engineering competence, creativity, imagination, confidence and responsibility;

4. occupy positions of increasing responsibility and/or assignments and aspire to positions of leadership within their profession for enhanced community participation and qualitative service delivery; and
5. exhibit the highest ethical and professional standards, and, as agents of positive change, communicate the importance and excitement of Mechanical Engineering.

Unique Features of the Programme

Some unique features of the programme include:
1. stimulating intellect and encouraging students towards developing ingenuity and originality in problem solving;
2. encouraging students to maintain intellectual curiosity that will motivate them to pursue meaningful lifelong learning; and
3. equiping students with the relevant intellectual capacity, contemporary software proficiency, communication, entrepreneurial and
4. other relevant soft skills like teamwork, flexibility, adaptability and interpersonal knack to engage effectively in engineering practice, business and in leadership roles.

Employability Skills

Graduates of this programme may find jobs in diverse sectors as:
1. in the automobile, aerospace, biomedical, building and construction, food and beverages, manufacturing, oil and gas, power, petrochemical and process, railway and telecommunication industries;
2. industrial systems engineers, product designers, managers, researchers, applied mathematicians, and, of course, performing a multitude of other traditional Mechanical Engineering duties; and
3. to become Entrepreneur (employer of labour in field relating to Mechanical Engineering).

The curriculum is designed to:
1. equip graduates of the Mechanical Engineering programme with the intellectual capacity (to apply the principles of physics, mathematics, materials science and engineering problem-solving techniques) and relevant contemporary skills;
2. offer students skills that are highly sought after and highly remunerated in industry;
3. prepare graduates to undertake the challenge of working on a wide range of projects, with the prospect of working with a broad spectrum of other professionals; and
4. develop successful careers as mechanical engineers and apply their mechanical engineering education to address the full range of technical and societal problems with professional engineering competence, creativity, imagination, confidence and responsibility.

21st Century Skills

The programme emphasises such contemporary skills as:
1. developing ingenuity and originality in critical thinking/ problem solving/decision making;
2. creativity and innovation;
3. information literacy;
4. intellectual curiosity that will motivate them to pursue meaningful lifelong learning;
5. contemporary software proficiency;
6. effective communication skills;
7. entrepreneurial capability;
8. collaboration (teamwork and work ethic);
9. Flexibility and adaptability; and
10. Learning how to learn/metacognition.

Admission and Graduation Requirements

Admission Requirements

Candidates are admitted into the degree programme in either of the following two ways:

1. Unified Tertiary Matriculation Examination (UTME) Mode (5 Year Degree Programme)
2. Direct Entry (DE) Mode (4 Year Degree Programme)

Unified Tertiary Matriculation Examination (UTME) Mode

For the five-year degree programme, in addition to acceptable passes in the Unified Tertiary Matriculation Examination (UTME), the minimum admission requirement is credit level passes in Senior School Certificate (SSC) in at least five subjects, which must include English Language, Mathematics, Physics, Chemistry and other acceptable science subjects at not more than two sittings.

Direct Entry (DE) Mode

For four-year Direct Entry, in addition to five (5) Senior School Certificate (SSC) credit passes which must include English Language, Mathematics, Physics and Chemistry, candidates with at least two passes in relevant subjects (Mathematics, Physics and Chemistry) at the GCE Advanced Level or IJMB or JUPEB may be considered for admission. Candidates who have good National Diploma (ND) result in relevant Engineering Technology programmes may also be considered for admission into 200 level. Holders of upper credit pass and above at Higher National Diploma (HND) level, are eligible for consideration for admission into 300 level.

Graduation Requirements

The following regulations shall govern the conditions for the award of a honours degree in Engineering and Technology:

1. Candidates admitted through the UTME mode shall have registered for a minimum of 150 and maximum of 180 units of courses during the 5–year engineering degree programme. Such candidates shall have spent a minimum of ten academic semesters.
2. Candidates admitted through the Direct entry mode shall have registered for minimum of 120 and maximum of 150 units of courses during a 4–year engineering degree programme. Such candidates shall have spent a minimum of eight academic semesters
3. The minimum and maximum credit load per semester is 15 and 24 credit units respectively.
4. A student shall have completed and passed all the Courses registered for, including all compulsory courses and such elective /optional courses as may be specified by the university/faculty or department; obtained a minimum Cumulative Grade Point Average (CGPA) specified by the university but not less than 1.00.
5. A student shall also have earned the 15 credit units of Students Industrial Work Experience Scheme (SIWES), 8 credit units of University General Study courses and four credit units of Entrepreneurship courses.

For the purpose of calculating a student's cumulative grade point average (CGPA) in order to determine the class of Degree to be awarded, grades obtained in ALL the courses registered, whether compulsory or optional and whether passed or failed must be included in the computation. Even when a student repeats the same course once or more before passing it or substitutes another course for a failed optional course, grades scored at each and all attempts shall be included in the computation of the GPA.

Prerequisite courses must be taken and passed before a particular course at a higher level. Furthermore, if a student fails to graduate at the end of normal academic session, he or she would not be allowed to exceed a total of 15 semesters in the case of students admitted through UTME and 13 semesters in the case of Direct Entry students.

Global Course Structure Level	GST/ENT	Basic Science	Discipline GET	Programme (MEE)	SIWES	Total Units
100	4	18	3	1	-	26
200	4	-	26	-	3	33
300	4	-	15	0	4	23
400	-	-	-	2	8	10
500	-	-	5	8	-	13
Total	**12**	**18**	**52**	**23**	**15***	**105**

COURSE STRUCTURE
100 Level

Course Code	Course Title	Units	Status	LH	PH
GST 111	Communication in English	2	C	15	45
GST 112	Nigerian People and Culture	2	C	30	-
GET 101	Engineer in Society	1	C	15	-
GET 102	Engineering Graphics and Solid Modelling I	2	C	15	45
CHM 101	General Chemistry I	2	C	30	-
CHM 102	General Chemistry II	2	C	30	-
CHM 107	General Practical Chemistry I	1	C	-	45
CHM 108	General Practical Chemistry II	1	C	-	45
MTH 101	Elementary Mathematics I	2	C	30	-
MTH 102	Elementary Mathematics II	2	C	30	-
MTH 103	Elementary Mathematics III	2	C	30	-
PHY 101	General Physics I	2	C	30	-
PHY 103	General Physics III	2	C	30	-
PHY 107	General Practical Physics I	1	C	-	45
PHY 108	General Practical Physics II	1	C	-	45
MEE 101	Introduction to Mechanical Engineering	1	C	15	-
BIU-PHY 103	General Physics III (Electricity and Magnetism)	2	C	30	-
BIU-PHY 104	General Physics IV (Vibration, Waves and Optics)	2	C	30	-
BIU-STAT 112	Probability	2	C	30	-
BIU-IDS 111	Rudiments of Christian Life	1	C	15	-
BIU-IDS 121	Christian Life	1	C	15	-
Total		**34**			

200 Level

Course Code	Course Title	Units	Status	LH	PH
GST 212	Philosophy, Logic and Human Existence	2	C	30	-
ENT 211	Entrepreneurship and Innovation	2	C	30	-
GET 201	Applied Electricity I	3	C	45	-
GET 202	Engineering Materials	3	C	45	-
GET 204	Students Workshop Practice	2	C	15	45
GET 205	Fundamentals of Fluid Mechanics	3	C	45	-
GET 206	Fundamentals of Thermodynamics	3	C	45	-
GET 208	Strength of Materials	3	C	45	-
GET 209	Engineering Mathematics I	3	C	45	-
GET 210	Engineering Mathematics II	3	C	45	-
GET 211	Computing and Software Engineering	3	C	30	45
BIU-GET 203	Engineering Graphics and Solid Modeling II	2	C	15	45
BIU-GET 207	Applied Mechanics	2	C	30	-
*GET 299	SIWES I	3	C	9 wks	
Total	**34**				

300 Level

Course Code	Course Title	Units	Status	LH	PH
GST 312	Peace and Conflict Resolution	2	C	30	-
ENT 312	Venture Creation	2	C	15	45
GET 301	Engineering Mathematics III	3	C	45	-
GET 302	Engineering Mathematics IV	3	C	45	-
GET 304	Technical Writing and Communication (including Seminar Presentation Skills)	3	C	45	-
GET 305	Engineering Statistics and Data Analytics.	3	C	45	-
GET 306	Renewable Energy Systems and Technology	3	C	30	45
GET 307	Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies	3	C	45	-
MEE 306	Computer-Aided Design and Manufacture	1	E	-	45
BIU-MEE 305	Mechanics of Machines I	2	C	30	-
BIU-GET 314	Engineering Economics	2	C	30	
BIU-MEE 307	Engineering Thermodynamics II	2	C	30	-
BIU-MEE 310	Laboratory Practice I	1	C	-	45
BIU-MEE 313	Laboratory Practice II	1	C	-	45
ELECTIVES: Select one course from the electives					
BIU-MEE 309	Manufacturing and Production Technology	2	E	30	-
BIU-MEE 312	Machine Design I	2	E	15	45
*GET 399	SIWES II	4	C	12 wks	-
Total		**36**			

400 Level

Course Code	Course Title	Units	Status	LH	PH
MEE 401	Mechanical (Machine) Engineering Design II	2	C	30	-
MEE 402	Theory (Mechanics) of Machines I	2	C	30	-
MEE 403	Applied (Engineering) Thermodynamics I	2	C	30	-
MEE 405	Heat and Mass Transfer	3	C	45	-
BIU-MEE 408	Control Systems Engineering	2	C	15	45
BIU-MEE 410	Production Technology I	2	C	15	45
BIU-MEE 410	Advanced Mathematics for Mechanical Engineering	2	C	30	-
BIU-MEE 411	Laboratory Practice III	1	C	-	45
ELECTIVES: Select one course from the electives					
MEE 404	Applied Fluid Mechanics	2	E	30	-
MEE 407	Advanced Mechanics of Materials	2	E	30	-
BIU-MEE 408	Strength of Engineering Materials II	2	E	15	45
BIU-MEE 409	Failure Analysis and Prevention	2	E	15	45
Total		**18**			

SIWES Course

Course Code	Course Title	Units	Status	LH/PH
GET 299	SIWES I: SWEP	3	C	9 weeks
GET 399	SIWES II	4	C	12 weeks
GET 499	SIWES III	8	C	24weeks
Total		15*		

* All credited in the 2nd Semester of 400-level

500 Level

Course Code	Course Title	Units	Status	LH	PH
GET 501	Engineering (Project) Management	3	C	45	-
GET 502	Engineering Law	2	C	30	-
MEE 501	Applied Design	2	C	15	45
MEE 590	B.Eng. Project	6	C	-	270
BIU-MEE 505	Internal Combustion Engine	2	C	15	45
BIU-MEE 506	Production Technology II	2	C	15	45
BIU-MEE 507	Refrigeration & Air- conditioning	2	C	30	-
BIU-MEE 508	Engineering Maintenance and Reliability	2	C	15	45
BIU-MEE 512	Computer Applications in Mechanical Engineering	2	C	15	45
BIU-MEE 516	Automobile Engineering	2	C	15	45

BIU-MEE 509	Stress Analysis	2	C	30	-
BIU-MEE 513	Product Design	2	C	30	-
ELECTIVES: Select two courses from the electives					
BIU-MEE 510	Metallurgy of Materials Production and Processing	2	E	30	-
BIU-MEE 511	Turbo Machinery	2	E	30	-
BIU-MEE 514	Bioengineering	2	E	30	-
BIU-MEE 513	Fluid Machinery	2	E	30	-
Total:		**33**			

Course Contents and Learning Outcomes

100 Level

GST 111: Communication in English (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students should be able to:

1. identify possible sound patterns in English Language;
2. list notable language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

Course Contents

Sounds and sound patterns in English Language (vowels and consonants, phonetics and phonology); English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations); major word formation processes; the sentence in English (types: structural and functional); grammar and usage (tense, concord and modality). Reading and types of reading, comprehension skills, 3RsQ. Logical and critical thinking; reasoning methods (logic and syllogism, inductive and deductive argument, analogy, generalisation and explanations). Ethical considerations, copyright rules and infringements. Writing activities (pre-writing (brainstorming and outlining), writing (paragraphing, punctuation and expression), post- writing (editing and proofreading). Types of writing(summary, essays, letter, curriculum vitae, report writing, note-making). etc. Mechanics of writing. Information and Communication Technology in modern language learning. Language skills for effective communication. The art of public speaking.

GST 112: Nigerian Peoples and Cultures (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. analyse the historical foundation of Nigerian cultures and arts in pre-colonial times;
2. identify and list the major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political entity;
4. analyse the concepts of trade and economic self-reliance of Nigerian peoples in relation to national development;

5. enumerate the challenges of the Nigerian state regarding nation building;
6. analyse the role of the judiciary in upholding fundamental human rights
7. identify the acceptable norms and values of the major ethnic groups in Nigeria; and
8. list possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents

Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and cultures; peoples and cultures of the minority ethnic groups). Nigeria under colonial rule (advent of colonial rule in Nigeria; colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; nationalist movement and struggle for independence). Nigeria and challenges of nation building (military intervention in Nigerian politics; Nigerian Civil War). Concepts of trade and economics of self-reliance (indigenous trade and market system; indigenous apprenticeship system among Nigerian peoples; trade, skill acquisition and self-reliance). Social justice and national development (definition and classification of law); Judiciary and fundamental rights. Individuals, norms and values (basic Nigerian norms and values, patterns of citizenship acquisition; citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts [Cultism, kidnapping and other related social vices]). Re-orientation, moral and national values (The 3Rs – Reconstruction, Rehabilitation and Re-orientation; re-orientation strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline and Corruption (WAIC), Mass Mobilization for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

GET 101: Engineer in Society (1 Unit C: LH 15)

Learning Outcomes

At the end of this course, the students should be able to:
1. differentiate between science, engineering and technology, and relate them to innovation;
2. distinguish between the different cadres of engineering – engineers, technologists, technicians and craftsmen and their respective roles and competencies;
3. identify and distinguish between the relevant professional bodies in engineering;
4. categorise the goals of global development or sustainable development goals (SDGs); and
5. identify and evaluate safety and risk in engineering practice.

Course Contents

History, evolution and philosophy of science. engineering and technology. The engineering profession – engineering family (engineers, technologists, technicians and craftsmen), professional bodies and societies. Engineers' code of conduct and ethics, and engineering literacy. Sustainable development goals (SDGs), innovation, infrastructures and nation building - economy, politics, business. Safety and risk analysis in engineering practice. Engineering competency skills – curriculum overview, technical, soft and digital skills. Guest seminars and invited lectures from different engineering professional associations.

GET 102: Engineering Graphics and Solid Modelling I (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. have a good grasp of design thinking and be obsessed with the determination to apply such to solving simple everyday and also complex problems;
2. recognise the fundamental concepts of engineering drawing and graphics;
3. show skills to represent the world of engineering objects in actionable solid models, and put such models in a form where they can be inputs for simulation and analyses;
4. analyse such models for strength and cost;
5. prepare the objects for modern production and manufacturing techniques of additive and subtractive manufacturing;
6. recognise that engineering is multidisciplinary in the sense that mechanical, electrical and other parts of physical structures are modelled in context as opposed to the analytical nature of the courses they take; and
7. analyse and master the basics of mechanical and thermal loads in engineering systems.

Course Contents

Introduction to design thinking and engineering graphics. First and third angle orthogonal projections. Isometric projections; sectioning, conventional practices, conic sections and development. Freehand and guided sketching – pictorial and orthographic. Visualisation and solid modelling in design, prototyping and product-making. User interfaces in concrete terms. Design, drawing, animation, rendering and simulation workspaces. Sketching of 3D objects. Viewports and sectioning to shop drawings in orthographic projections and perspectives. Automated viewports. Sheet metal and surface modelling. Material selection and rendering. This course will use latest professional design tools such as fusion 360, solid works, solid edge or equivalent.

CHM 101: General Chemistry I (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. define atom, molecules and chemical reactions;
2. discuss the modern electronic theory of atoms;
3. write electronic configurations of elements on the periodic table;
4. rationalise the trends of atomic radii, ionisation energies, electronegativity of the elements, based on their position in the periodic table;
5. identify and balance oxidation–reduction equation and solve redox titration problems;
6. draw shapes of simple molecules and hybridised orbitals;
7. identify the characteristics of acids, bases and salts, and solve problems based on their quantitative relationship;
8. apply the principles of equilibrium to aqueous systems using LeChatelier's principle to predict the effect of concentration, pressure and temperature changes on equilibrium mixtures;
9. analyse and perform calculations with the thermodynamic functions, enthalpy, entropy and free energy; and
10. determine rates of reactions and its dependence on concentration, time and temperature.

Course Contents

Atoms, molecules, elements and compounds, and chemical reactions. Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridisation and shapes of simple molecules. Valence forces; Structure of solids. Chemical equations and stoichiometry;

chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry. Radioactivity.

CHM 102: General Chemistry II (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:

1. state the importance and development of organic chemistry;
2. define fullerenes and its applications;
3. discuss electronic theory;
4. determine the qualitative and quantitative of structures in organic chemistry;
5. state rules guiding nomenclature and functional group classes of organic chemistry;
6. determine the rate of reaction to predict mechanisms of reaction;
7. identify classes of organic functional group with brief description of their chemistry;
8. discuss comparative chemistry of group 1A, IIA and IVA elements; and
9. describe basic properties of transition metals.

Course Contents

Historical survey of the development and importance of organic chemistry; fullerenes as fourth allotrope of carbon, uses as nanotubules, nanostructures, nanochemistry. Electronic theory in organic chemistry. Isolation and purification of organic compounds; determination of structures of organic compounds including qualitative and quantitative analysis in organic chemistry; nomenclature and functional group classes of organic compounds. Introductory reaction mechanism and kinetics. Stereochemistry. The chemistry of alkanes, alkenes, alkynes, alcohols, ethers, amines, alkyl halides, nitriles, aldehydes, ketones, carboxylic acids and derivatives. The chemistry of selected metals and non-metals. Comparative chemistry of group IA, IIA and IVA elements. Introduction to transition metal chemistry.

CHM 107: General Practical Chemistry I (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. state the general laboratory rules and safety procedures;
2. collect scientific data and correct carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. state the differences between primary and secondary standards;
5. perform redox titration;
6. record observations and measurements in the laboratory notebooks; and
7. analyse the data to arrive at scientific conclusions.

Course Contents

Laboratory experiments designed to reflect topics presented in courses CHM 101 and CHM 102. These include acid-base titrations, qualitative analysis, redox reactions, gravimetric analysis, data analysis and presentation.

CHM 108: General Practical Chemistry II (1 Unit C: PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. state the general laboratory rules and safety procedures;
2. collect scientific data and correctly carry out chemical experiments;
3. identify the basic glassware and equipment in the laboratory;
4. identify and carry out preliminary tests which include ignition, boiling point, melting point, test on known and unknown organic compounds;
5. carry out solubility tests on known and unknown organic compounds;
6. carry out elemental tests on known and unknown compounds; and
7. carry out functional group/confirmatory test on known and unknown compounds which could be acidic/basic/ neutral organic compounds.

Course Contents

Continuation of CHM 107. Additional laboratory experiments to include functional group analysis, quantitative analysis using volumetric methods.

MTH 101: Elementary Mathematics I (Algebra and Trigonometry) (2 Units C: LH 30)

Learning Outcomes

At the end of the course students should be able to:

1. define and explain set, subset, union, intersection, complements, and demonstrate the use of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. identify various types of numbers; and
5. solve some problems using binomial theorem.

Course Contents

Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Real numbers, integers, rational and irrational numbers. Mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem, complex numbers, algebra of complex numbers, the argand diagram. De-Moiré's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

MTH 102: Elementary Mathematics II (Calculus) (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. identify the types of rules in differentiation and integration;
2. recognise and understand the meaning of function of a real variable, graphs, limits and continuity;
3. solve some applications of definite integrals in areas and volumes;
4. solve function of a real variable, plot relevant graphs, identify limits and idea of continuity;
5. identify the derivative as limit of rate of change;
6. identify techniques of differentiation and perform extreme curve sketching;
7. identify integration as an inverse of differentiation;
8. identify methods of integration and definite integrals; and
9. perform integration application to areas, volumes.

Course Contents

Functions of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change. Techniques of differentiation, maxima and minima. Extreme curve sketching, integration, definite integrals, reduction formulae, application to areas, volumes (including approximate integration: Trapezium and Simpson's rule).

MTH 103: Elementary Mathematics III (Vectors, Geometry and Dynamics) (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:
1. solve some vectors in addition and multiplication;
2. calculate force and momentum; and
3. solve differentiation and integration of vectors.

Course Contents

(Pre-requisite –MTH 101)

Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition, scalar, multiplication of vectors, linear independence. Scalar and vector products of two vectors. Differentiation and integration of vectors with respect to a scalar variable. Two-dimensional co-ordinate geometry. Straight lines, circles, parabola, ellipse, hyperbola. Tangents, normals. Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles and resisted vertical motion. Elastic string and simple pendulum. Impulse, impact of two smooth spheres and a sphere on a smooth surface.

PHY 101: General Physics I (Mechanics) (2 Units C: LH 30)

Learning Outcomes

On completion, the students should be able to:
1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;
4. apply Newton’s laws to describe and solve simple problems of motion;
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum;
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Contents

Space and time; units and dimension, vectors and scalars, differentiation of vectors: displacement, velocity and acceleration; kinematics; Newton’s laws of motion (inertial frames, impulse, force and action at a distance, momentum conservation); relative motion; application of Newtonian mechanics; equations of motion; conservation principles in physics, conservative forces, conservation of linear momentum, kinetic energy and work, potential energy, system of particles, centre of mass; rotational motion; torque, vector product, moment, rotation of coordinate axes and angular momentum. Polar coordinates; conservation of angular momentum; circular motion; moments of inertia, gyroscopes and precession; gravitation: Newton's law of gravitation, Kepler's laws of planetary motion, gravitational potential energy, escape velocity, satellites motion and orbits.

PHY 103: General Physics III (Behaviour of Matter) (2 Units C: LH 30)

Learning Outcomes

On completion, the students should be able to:

1. explain the concepts of heat and temperature and relate the temperature scales;
2. define, derive and apply the fundamental thermodynamic relations to thermal systems;
3. describe and explain the first and second laws of thermodynamics, and the concept of entropy;
4. state the assumptions of the kinetic theory and apply techniques of describing macroscopic behaviour;
5. deduce the formalism of thermodynamics and apply it to simple systems in thermal equilibrium; and
6. describe and determine the effect of forces and deformation of materials and surfaces.

Course Contents

Heat and temperature, temperature scales; gas laws; general gas equation; thermal conductivity; first Law of thermodynamics; heat, work and internal energy, reversibility; thermodynamic processes; adiabatic, isothermal, isobaric; second law of thermodynamics; heat engines and entropy, Zero's law of thermodynamics; kinetic theory of gases; molecular collisions and mean free path; elasticity; Hooke's law, Young's shear and bulk moduli; hydrostatics; pressure, buoyancy, Archimedes' principles; Bernoullis equation and incompressible fluid flow; surface tension; adhesion, cohesion, viscosity, capillarity, drops and bubbles.

PHY 107: General Practical Physics I (1 Unit C: PH 45)

Learning Outcomes

On completion, the student should be able to:

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs; and
5. draw conclusions from numerical and graphical analysis of data.

Course Contents

This introductory course emphasizes quantitative measurements. Experimental techniques. The treatment of measurement errors. Graphical analysis. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc. (covered in PHY 101, 102, 103 and PHY 104). However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis, and deduction.

PHY 108: General Practical Physics II (1 Unit C: PH 45)

Learning Outcomes

On completion, the student should be able to:

1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs;
5. draw conclusions from numerical and graphical analysis of data; and

6. prepare and present practical reports.

Course Contents

This practical course is a continuation of PHY 107 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

MEE 101: Introduction to Mechanical Engineering (1 Units C: LH 15)

Learning Outcomes:

At the end of this course, the students should be able to:

1. differentiate between science, engineering and technology, and relate them to innovation;
2. identify the various branches of mechanical engineering discipline and their applications to the solution of societal problems;
3. demonstrate appreciation of the problem of climate change; and
4. demonstrate appreciation of the role of energy systems to environmental sustainability.

Course Contents

Historical development of the mechanical engineering discipline. Philosophy and scope of contemporary mechanical engineering course programme. Overview of mechanical engineering special fields: applied (solid) mechanics, fluid and thermal engineering (thermodynamics and heat transfer). Industrial/production engineering and engineering management sciences. The linkage between mechanical engineering and other engineering disciplines and the sciences. The concept of innovation. Illustrations of a wide variety applications of mechanical engineering. The role of mechanical engineers in the society and human development. Professional ethical responsibility. Climate change, renewable energy and environmental sustainability.

BIU-PHY **102 General Physics II (Electricity & Magnetism)**, (2 Units; Core (C); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in General Physics to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU’s mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent Mechanical Engineering graduates. Relevance is seen in General Physics from BIU being able to develop techniques that would enhance analytical knowledge in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

The goal of the course is to develop an understanding of the fundamental laws of physics, in particular, electricity and magnetism, with applications to electronics, optics, and new challenges in renewable energy sources. This course introduces electricity and magnetism to science and engineering majors in an applied and calculus-based way. It also emphasis’s on the rigorous utilization of the scientific method in labs. Thematic in this course are the various interactions between the electric and magnetic fields. The course begins slowly, acclimating students to the concepts of charge and how they relate to electricity and magnetism. It progresses in a logical way, moving onto charge distributions and how they generate electric fields (Gauss' Law). This translates well to the later focus on circuits, induction, and complex impedance. The course concludes with units on interference and diffraction and properties of light.

Moreover, electricity and magnetism are two related phenomena produced by the electromagnetic force. Together, they form electromagnetism. A moving electric charge generates a magnetic field. A magnetic field induces electric charge movement, producing an electric current. Electricity is the phenomenon associated with either stationary or moving electric charges. The source of the electric charge could be an elementary particle, an electron (which has a negative charge), a proton (which has a positive charge), an ion, or any larger body that has an imbalance of positive and negative charge. Positive and negative charges attracts each other (e.g., protons are attracted to electrons), while like charges repel each other (e.g., protons repel other protons and electrons repel other electrons).

Electricity and magnetism are two very important topics in the science of physics. Electricity is used to power computers and to make motors move easily from one location to another. Magnetism makes a compass point North and keeps notes stuck onto our refrigerators

Objectives

The objectives of the course are to:
1. describe the electric field and potential, and related concepts, for stationary charges;
2. state the electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. solve problems using Coulomb's law, Gauss's law, and electric potential;
4. determine the magnetic field for steady and moving charges;
5. state the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
6. describe electromagnetic induction and related concepts;
7. solve problems using Faraday and Lenz's laws;
8. explain basic physical significance of Maxwell's equations in integral form;
9. evaluate DC circuits to determine the electrical parameters;
10. state characteristics of AC voltages and currents in resistors, capacitors, and Inductors.

Learning Outcomes

At the end of the course, students should be able to:
1. describe the electric field and potential, and at least two related concepts, for stationary charges;
2. state at least three electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. solve at least three problems each using Coulomb's law, Gauss's law, and electric potential;
4. determine the magnetic field for steady and moving charges;
5. state at least three magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
6. describe electromagnetic induction and at least three related concepts;
7. solve at least three calculations using Faraday and Lenz's laws;
8. explain at least three basic physical significance of Maxwell's equations in integral form;
9. evaluate DC circuits to determine the at least three electrical parameters;

10. determine at least three characteristics of AC voltages and currents in resistors, capacitors, and Inductors.

Course Contents

Forces in nature. Electrostatics (electric charge and its properties, methods of charging). Coulomb's law and superposition. Electric field and potential. Gauss's law. Capacitance. Electric dipoles. Energy in electric fields. Conductors and insulators. DC circuits (current, voltage and resistance). Ohm's law. Resistor combinations. Analysis of DC circuits. Magnetic fields. Lorentz force. Biot-Savart and Ampère's laws. Magnetic dipoles. Dielectrics. Energy in magnetic fields. Electromotive force. Electromagnetic induction. Self and mutual inductances. Faraday and Lenz's laws. Step up and step down transformers. Maxwell's equations. Electromagnetic oscillations and waves. AC voltages and currents applied to inductors, capacitors, and resistance.

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities

BIU-PHY **104 General Physics IV (Vibration, Waves and Optics)** (2 Units; Core (C); LH =30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in Vibration, Waves and Optics to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Vibration, Waves and Optics from BIU being able to develop techniques that would enhance adequate knowledge in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Waves and oscillations characterize many different physical systems, including vibrating strings, springs, water waves, sound waves, electromagnetic waves, and gravitational waves. Quantum mechanics even describes particles with wave functions. Despite these diverse settings waves exhibit several common characteristics, so that the understanding of a few simple systems can provide insight into a wide array of phenomena.

This course begins with the study of oscillations of simple systems with only a few degrees of freedom. This is followed by study transverse and longitudinal waves in continuous media in order to gain a general description of wave behavior. The rest of the course focuses on electromagnetic waves and in particular on optical examples of wave phenomena. In addition to well-known optical effects such as interference and diffraction, a number of modern applications of optics such as short pulse lasers and optical communications are studied.

Objectives

The objectives of the course are to:

1. describe and quantitatively analyse the behaviour of vibrating systems and wave energy;

2. explain the propagation and properties of waves in sound and light;
3. identify and apply the wave equations;
4. explain geometrical optics and state the principles of optical instruments;
5. define the concept of wave,
6. describe the wave motion and derive the wave equation;
6. describe the propagation of elastic waves in a solid rod, in a spring and an ideal gases and solve related exercises/ problems;
7. derive the laws of reflection and refraction of light waves using the Huygens' and Fermat's principles;
8. apply the Principle of Superposition for Waves to explain the phenomena of interference of waves, standing waves and resonance;
9. describe standing waves on a string and in a vibrating column of air and solve related exercises / problems;
10 explain the Classical and relativistic Doppler effects and solve related exercises/ problems;
11. analyse the formation of images in spherical mirrors, thin – lenses and optical instruments and solve related exercises/problems.

Learning Outcomes

At the end of the course, students should be able to:
1. describe and quantitatively analyse at least two of behaviour of vibrating systems and wave energy;
2. explain the propagation and at least three properties of waves in sound and light;
3. solve at least three problems using the wave equations;
4. explain geometrical optics and state at least three principles of optical instruments;
5. define at least four concepts of wave,
6. describe the wave motion and derive the wave equation;
6. describe the propagation of elastic waves in a solid rod, in a spring and an ideal gas and solve at least four problems;
7. derive the laws of reflection and refraction of light waves using the Huygens' and Fermat's principles;
8. apply the Principle of Superposition for Waves to explain the phenomena of interference of waves, standing waves and resonance;
9. describe standing waves on a string and in a vibrating column of air and solve at least three problems each;
10 explain the Classical and relativistic Doppler effects and solve at least three problems;
11. analyze the formation of images in spherical mirrors, thin – lenses and optical instruments and solve at least four problems.

Course Contents

Simple harmonic motion (SHM). Energy in a vibrating system. Damped SHM. Resonance and transients. Coupled SHM. Q values and power response curves. Normal modes. Waves (types and properties of waves as applied to sound). Transverse and longitudinal waves (superposition, interference, diffraction, dispersion, polarization). Waves at interfaces (energy and power of waves). The wave equation. 2-D and 3-D wave equations. Wave energy and power. Phase and group velocities. Echo and beats. The Doppler-effect. Propagation of sound in gases, solids and liquids and their properties.

Optics: Nature and propagation of light. Reflection and refraction. Internal reflection. Scattering of light. Reflection and refraction at plane and spherical surfaces. Thin lenses and optical instruments. Wave nature of light. Dispersion. Huygens's principle (interference and diffraction).

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities.

BIU-STAT **112 Probability**, (2 Units; Core (C); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in Probability enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent Mechanical Engineering graduates. Relevance is seen in statistical Probability from BIU being able to develop techniques that would enhance analytical knowledge in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Overview

Statistics is the science that involves the collection, organizing, analyzing, and interpretation of data in order to make decisions. Statistics is a vital tool for robust analysis, measurement system, error analysis, test data analysis, probabilistic risk assessment, etc, in Mechanical Engineering and other engineering fields.

This course will equip the students during their study and afterwards, in the aspect of design of experiment (DOE) by applying statistical methods in testing and constructing models for Mechanical engineering elements and design, quality control, reliability analysis of mechanical infrastructures, probabilistic design of structures and formulation of predictive models etc. This helps in proper design, quantification of risks, and ascertaining the integrity of existing mechanical designs and fabrication, thus preventing the sudden failure of engineering facilities in Nigeria.

Objectives

The objectives of the course are to:

1. define statistics;
2. state the importance of Statistics;
3. explain the different types of statistics;
4. compute the location and dispersion using ungrouped and grouped data;
5. differentiate between deterministic and statistical (Stochastic) models;
6. state the differences among: binomial distribution, normal distribution, geometric distributions, poisson distribution, negative binomial distributions and exponential distribution;
7. describe reliability function and express the function mathematically;
8. explain regression and demonstrate linear regression analysis on set of given data.
9. solve permutation and combination problems;
10. state the concepts and principles of probability;
11. solve problems on probability and distribution functions;
12. apply the binomial, geometric, Poisson, normal and sampling distributions to solve problems.

Learning Outcomes

At the end of the course, students should be able to:
1. define statistics;
2. explain at least three importance of Statistics;
3. explain at least three different types of statistics;
4. solve at least three problems involving location and dispersion using ungrouped and grouped data;
5. differentiate between deterministic and statistical (Stochastic) models;
6. state at least three differences among: binomial distribution, normal distribution, geometric distributions, poisson distribution, negative binomial distributions and exponential distribution;
7. describe reliability function and express the function mathematically;
8. explain regression;
9. solve at least three problems of linear regression analysis on set of given data;
10. solve at least three problems each on permutation and combination;
11. state at least three concepts and principles of probability;
12. solve at least four problems on probability and distribution functions;
13. apply the binomial, geometric, Poisson, normal and sampling distributions to solve at least three problems.

Course Contents

Definition of statistics. Application of statistics. Types of statistics. Descriptive statistics and inferential statistics). Measurement of location in ungroup and group data. Measure of dispersion in ungroup and group data. Deterministic and Statistical (Stochastic) Models. Elements of probability distribution. Binomial Distribution, Normal Distribution. Geometric Distributions. Poisson distribution. Negative Binomial Distributions. Exponential Distribution. Reliability function. Estimation and tests of hypothesis concerning the parameters of the distributions. Regression analysis. Correlation. Analysis of variable. Contingency table and non-parametric inference. Permutation and combination. Concepts and principles of probability. Random variables. Probability and distribution functions. Basic distributions: Binomial, geometric, Poisson, normal and sampling distributions; exploratory data analysis.

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities.

BIU-IDS **111 Rudiments of Christian Life**, (1 Units; Core (C); LH = 15)

Senate-approved relevance

Benson Idahosa University is a Christian University whose core value is not just to raise academics but professionals and entrepreneurs who will be effective Disciples for Christ by excelling in their chosen professional fields. Therefore, this course is aimed at providing every student admitted into the university with the fundamental knowledge of the Christian faith. The relevance of the course is seen in the area of enhancing the Christian knowledge of the students, ethical and spiritual values so that they can become responsible and productive members of the Nigerian society.

Course Overview

From biblical point of view, life outside God is mere existence. For anyone to experience purposeful and meaningful life such must be equipped with the basic knowledge of Christianity. The rudiments of Christian faith affords one the opportunity of understanding the doctrine of salvation, the Christian personal life, Christian marriage, its uniqueness and the Bible as God's eternal word.

Furthermore, various views on the state of man at creation will be evaluated. The three aspects of salvation, Divine means of salvation are explained, In addition, the Christian personal life, his personal walk and required responsibilities are unveiled. This course also emphasizes the nitty-gritty of Christian marriage and historical development of the Bible.

Objectives

The basic objective of the course in specific forms are to:

1. identify the various definitions or meanings of salvation and other salvific concepts;
2. identify other aspects of salvation and divine means of salvation;
3. identify divergent views about the original state of man at creation;
4. examine the Christian personal life and required responsibilities.
5. examine the uniqueness of Christian marriage vis-à-vis the other forms of marriages in Africa;
6. understand the concept of Christian youth and marriage;
7. identify God's order for various categories in the family;
8. examine the Bible and its historical development.

Learning Outcomes

At the end of this course, a student should be able to:

1. discuss the doctrine of salvation and mention at least two different definitions on salvation;
2, state at least three variant views of the original state of man at creation;
3. identify the Christian personal life and state at least four of the required responsibilities;
4. discuss at least two areas of the uniqueness of Christian marriage vis-à-vis the other types of marriages in Africa;
5. discuss the concept of Christian youth and marriage;
6. define the concept of Christian marriage and family and state at least two major reasons for divorce and re-marriage;
7. identify God's order for at least four various categories in the family;
8. state the origin of the Bible, three specific years of its historical development, biblical inspiration and canonicity.

Course Contents

The doctrine of salvation; the state of man. Three distinct views of the state of man: the protestant view, the catholic view, the rationalist view. The way of salvation (THE ORDO SALUTIS): repentance and faith. The three aspects of salvation: Justification Regeneration and Sanctification. The Divine means for salvation: the blood of Jesus Christ, the Holy Spirit, the Word of God. The Christian Personal Life: a personal walk, obedience to his word, serving with talents, preaching the gospel, worshipping with his money, responding with his time, showing hospitality and walking in the Holy Spirit. Christian marriage and family: what is Christian marriage? The Christian youth and marriage, God's order for various members of Christian family. Divorce and Re-marriage. The content of the Bible, Old and New Testament. Biblical translations from antiquity: the Septuagint, the Targum. The division of Hebrew scripture into both Old and New Testament. The Hebrew division of the Old Testament which include the law, the prophets and the writings. The English division of the Old Testament include: the Law, the Historical Books, the Wisdom Books subdivided into the major and minor prophets. The History, style of writing and type of material used for writing the New Testament such as the ostraka, he papyrus, the uncials, the miniscules and the lectionaries. The writings of the Church Fathers. The Division of the New Testament: The Gospels, the Pauline Epistles, the General Epistles and the Apocalypse. The History of English Translation, the Canon of the Bible, the Apocrypha Books, the inspiration of the Bible.

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities

BIU-IDS **121 Christain Life**, (1 Units; Core (C); LH = 15)

Senate-approved relevance

Archbishop Benson Idahosa was a spiritual colossus known in several parts of the world for his exceptional missionary exploits and outstanding evangelistic ministry. Therefore, the need to study his visionary, goal oriented and purpose driven life cannot be over emphasized. This course is very relevant because it will afford every student the opportunity of having a firsthand knowledge of the life and times of Archbishop Benson Idahosa. It will also enable the student to imbibe his salient qualities spiritual values and dogged faith in God.

Overview

In Christian history, few men have traversed the world with the message of the gospel like the Archbishop Benson Idahosa. An examination of the life of the Archbishop reveals a man saddled with the singular goal of saving and reaching humanity with the message of the gospel. The Archbishop Benson Idahosa's ministry was also characterized by outstanding miracles including the raising of dead back to life. Apart from his evangelistic outreaches he was also a voice to reckon with within the Nigerian political space.

Furthermore, his business acumen led him to establish hospitals, primary, secondary and tertiary institutions of higher learning such as Benson Idahosa University. An encounter with the historical details of his phenomenon life will help the students to be visionaries, goal oriented and trigger in every student the will to win in every sphere of their endeavor in life.

OBJECTIVES

The fundamental objectives of the course in specific forms are to:

1. examine the phenomenal life and times of the Archbishop Benson Idahosa;
2. identify some of his worldwide missionary efforts and worldwide ministry;
3. examine his early years and some challenges he scaled by his dogged faith in God;
4. identify his unique spiritual values and purpose driven life;
5. identify some of his contributions to societal peace and development in Nigeria;
6. examine his contributions to the spiritual growth of some famous ministers and ministry within Nigeria and across the globe;
7. expatiate on the relevance of theological (biblical) concepts such as: evangelism, missions and Discipleship;
8. explain the meaning of vision, goal setting and time management.

Learning Outcomes

At the end of the course, students should be able to:

1. discuss at least five specific areas on the life and times of Archbishop Benson Idahosa, his exceptional life history, and worldwide evangelistic ministry;
2. discuss his days of 'little beginnings', mention at least two of his major challenges and his eventual victory and progress in the midst turmoil;
3. Discuss at least three of his peculiar characteristics such as: unprecedented faith, his visionary life and unwaning missionary exploits;
4. mention at least two major ways he positively impacted the society through his business prowess and his influence in Nigerian governance (politics);
5. identify at least four of his outstanding legacies and imbibe some of his salient qualities (spiritual values) and appropriate his exemplary faith and Christian life;
6. state at least three methods of evangelism and two variant definitions and meaning of Evangelism, Missions and Discipleship;
7. discuss at least three ways to sustain one's vision and mobilize people to buy into it;
8. state clearly at least two major ways to be goal oriented;
9. discuss at least two secrets to life and time management.

Course Content

The definition of evangelism, the aim in evangelism, the 4C's of evangelism, New Testament concept of evangelism, motivations for evangelism, methods of evangelism, literature evangelism. The meaning of 'Disciple' Jesus concept of Discipleship, the demands of discipleship, definition of missions, origin of modern missionary movement and characteristics. Missionary work in the 20^{th} century. Studying the Life and Times of Archbishop Benson Idahosa through the work book FIRE IN HIS BONES. How to sustain your vision and mobilize people to buy into it. How to set and reach your goals. Taking your community by storm. Time and life management and how to invest your life.

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities.

200 Level

GST 212: Philosophy, Logic and Human Existence (2 Units C: LH 30)

Learning Outcomes

At the end of the course, students should be able to:

1. know the basic features of philosophy as an academic discipline;
2. identify the main branches of philosophy & the centrality of logic in philosophical discourse;
3. know the elementary rules of reasoning;
4. distinguish between valid and invalid arguments;
5. think critically and assess arguments in texts, conversations and day-to-day discussions;
6. critically assess the rationality or otherwise of human conduct under different existential conditions;
7. develop the capacity to extrapolate and deploy expertise in logic to other areas of knowledge, and
8. guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

Course Contents

Scope of philosophy; notions, meanings, branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic— the first nine rules of inference. Informal fallacies, laws of thought, nature of arguments. Valid and invalid arguments, logic of form and logic of content — deduction, induction and inferences. Creative and critical thinking. Impact of philosophy on human existence. Philosophy and politics, philosophy and human conduct, philosophy and religion, philosophy and human values, philosophy and character molding.

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation and risk-taking;
2. state the characteristics of an entrepreneur;
3. analyse the importance of micro and small businesses in wealth creation, employment generation and financial independence;
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe the stages in enterprise formation, partnership and networking, including business planning;
7. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
8. state the basic principles of e-commerce.

Course Contents

The concept of entrepreneurship (entrepreneurship, intrapreneurship/corporate entrepreneurship); theories, rationale and relevance of entrepreneurship (Schumpeterian and other perspectives, risk-taking, necessity and opportunity-based entrepreneurship, and creative destruction); characteristics of entrepreneurs (opportunity seeker, risk-taker, natural and nurtured, problem solver and change agent, innovator and creative thinker); entrepreneurial thinking (critical thinking, reflective thinking and creative thinking). Innovation (The concept of innovation, dimensions of innovation, change and innovation, knowledge and innovation). Enterprise formation, partnership and networking (basics of business plan, forms of business ownership, business registration and alliance formation, and joint ventures). Contemporary entrepreneurship issues (knowledge, skills and technology, intellectual property, virtual office and networking). Entrepreneurship in Nigeria (biography of inspirational entrepreneurs, youth and women entrepreneurship, entrepreneurship support institutions, youth enterprise networks and environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

GET 201: Applied Electricity I (3 Units C: LH 30; PH 45)

Learning Outcomes

Students will be able to:

1. discuss the fundamental concepts of electricity and electrical d.c. circuits;
2. state, explain and apply the basic d.c. circuit theorems;
3. explain the basic a.c. circuit theory; and
4. apply to solution of simple circuits.

Course contents

Fundamental concepts: Electric fields, charges, magnetic fields. current, B-H curves Kirchhoff's laws, superposition. Thevenin, Norton theorems, Reciprocity, RL, RC, RLC circuits. DC, AC bridges, Resistance, Capacitance, Inductance measurement, Transducers, Single phase circuits, Complex j - notation, AC circuits, impedance, admittance, susceptance.

GET 202: Engineering Materials (3 Units C: LH 45)
Learning Outcomes
At the end of this course, the students should be able to:
1. demonstrate the role of atoms and molecules (aggregates of atoms) in the building of solid/condensed matter known as engineering materials, the electrons quantum numbers and how the electrons are arranged in different atomic elements, and explain the role of electronic configuration and valence electrons in bonding;
2. define metals, alloys and metalloids, demonstrate mental picture of the solid mineral resources development as a relay race among four ‘athletes’: geologist, mining engineer, mineral processing technologist, process metallurgical engineer, and classify metallurgical engineering into 3Ps: process, physical and production;
3. explain the relationship between structure and properties of materials, characteristics, components and compositions of phase diagrams and phase transformations of solid solutions;
4. define ceramics, glass and constituents of glasses and understand application of ceramics in mining, building, art and craft industries;
5. define and classify polymers as a class of engineering materials and polymeric materials, demonstrate polymerisation reactions, their types and mechanism, and applications of polymers;
6. define properties, types and application of composite materials and fibres (synthetic and natural);
7. define and classify nanomaterials, demonstrate applications of nanomaterials, concept, design and classification of fracture mechanics, corrosion classification, including the five principal ways of controlling corrosion and metal finishing processes such as sherardising, galvanising and anodising; and
8. identify factors affecting the performance and service life of engineering materials/metals and metallography of metals/materials (materials anatomy), which enables metallurgical and materials engineers to prescribe appropriate solutions to test metals/materials fitness in service through structure-property-application relationships.

Course Contents
Basic material science; atomic structure, atomic bonding and crystal structures. Engineering materials situating metals and alloys; metals and alloys, classifications of metals, metal extraction processes using iron and steel (ferrous) and aluminium (nonferrous) as examples, phase diagrams/iron carbon diagrams, and mechanical workings of metals. Selection and applications of metals and alloys for specific applications in oil, aerospace, construction, manufacturing and transportation industries, among others. Ceramics (including glass); definition, properties, structure and classifications of ceramics. Bioactive and glass – ceramics. Toughing mechanism for ceramics. Polymers; definition of polymers as engineering materials, chemistry of polymeric materials, polymer crystallisation, polymer degradation and aging. Thermoplastic and thermosetting polymers and concepts of copolymers and homopolymers. Composites; definition, classification, characterisation, properties and composite. Applications of composites. Nanomaterials; definition, classification and applications of nanomaterials as emerging technology. Processing of nanomaterials including mechanical grinding, wet chemical synthesis, gas phase synthesis, sputtered plasma processing, microwave plasma processing and laser ablation. Integrity assessment of engineering materials; effect of engineering design, engineering materials processing, selection, manufacturing and assembling on the performance and service life of engineering materials. Metallography and fractography of materials. Mechanical testing (destructive testing) of materials such as compressive test, tensile test, hardness test, impact test, endurance limit and fatigue test. Non-destructive test (NDT) such as dye penetrant, x-ray and eddy current.

GET 204: Students Workshop Practice (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. identify various basic hands and machine tools, analogue and digital measurement devices and instruments, and acquire skills in their effective use and maintenance;
2. practically apply basic engineering technologies, including metrology, casting, metal forming and joining, materials removal, machine tooling (classification, cutting tool action, cutting forces, non-cutting production) and CNC machining technology;
3. master workshop and industrial safety practices, accident prevention and ergonomics;
4. physically recognise different electrical & electronic components like resistances, inductances, capacitances, diodes, transistors and their ratings;
5. connect electric circuits, understand different wiring schemes, and check ratings of common household electrical appliances and their basic maintenance; and
6. determine household and industrial energy consumption, and understand practical energy conservation measures.

Course Contents

The course comprises general, mechanical and electrical components: supervised hands-on experience in safe usage of tools and machines for selected tasks; Use of measuring instruments (calipers, micrometers, gauges, sine bar, wood planners, saws, sanders, and pattern making). Machine shop: lathe work shaping, milling, grinding, reaming, metal spinning. Hand tools, gas and arc welding, cutting, brazing and soldering. Foundry practice.Industrial safety and accident prevention, ergonomics, metrology. Casting processes. Metal forming processes: hot-working and cold-working processes (forging, press-tool work, spinning, etc.). Metal joining processes(welding, brazing and soldering). Heat treatment. Material removal processes. machine tools and classification. Simple theory of metal cutting. Tool action and cutting forces. Introduction to CNC machines. Supervised identification, use and care of various electrical and electronic components such as resistors, inductors, capacitors, diodes and transistors. Exposure to different electric circuits, wiring schemes, analogue and digital electrical and electronic measurements. Household and industrial energy consumption measurements. Practical energy conservation principles.

GET 205: Fundamentals of Fluid Mechanics (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to :

1. explain the properties of fluids;
2. determine forces in static fluids and fluids in motion;
3. determine whether a floating body will be stable;
4. determine the effect of various pipe fittings (valves, orifices, bends and elbows) on fluid flow in pipes;
5. measure flow parameters with venturi meters, orifice meters, weirs;
6. perform calculations based on principles of mass, momentum and energy conservation;
7. perform dimensional analysis and simple fluid modelling problems; and
8. specify the type and capacity of pumps and turbines for engineering applications.

Course Contents

Fluid properties, hydrostatics, fluid dynamics using principles of mass, momentum and energy conservation from a control volume approach. Flow measurements in pipes, dimensional analysis, and similitude, 2-dimensional flows. Hydropower systems.

GET 206: Fundamentals of Engineering Thermodynamics (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. describe basic concepts of thermodynamics, quantitative relations of Zeroth, first, second and third laws;
2. define and explain system, surrounding, closed and open system, control volume and control mass, extensive and intensive properties;
3. calculate absolute and gage pressure, and absolute temperature, calculate changes in kinetic, potential, enthalpy and internal energy;
4. evaluate the properties of pure substances i.e. evaluate the state of the pure substances such as compressed liquid, saturated liquid-vapour mixture and superheated vapour using property diagrams and tables; arrange the ideal and real gas equations of state,
5. formulate the first law of thermodynamics for a closed system i.e. organize the change in energy in the closed systems via heat and work transfer;
6. distinguish heat transfer by conduction, convection and radiation, and calculate the amount of heat energy transferred;
7. calculate the changes in moving boundary work, spring work, electrical work and shaft work in closed systems;
8. apply the first law of thermodynamics for closed systems and construct conservation of mass and energy equations;
9. formulate the first law of thermodynamics to the open systems i.e. describe steady-flow open system, apply the first law of thermodynamics to the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow;
10. construct energy and mass balance for unsteady-flow processes;
11. evaluate thermodynamic applications using second law of thermodynamics;
12. calculate thermal efficiency and coefficient of performance for heat engine, refrigerators and heat pumps; and
13. restate perpetual-motion machines, reversible and irreversible processes.

Course Contents

Basic concepts, definitions and laws (quantitative relations of Zeroth, first, second and third laws of thermodynamics). Properties of pure substances: the two-property rule (P-V-T behaviour of pure substances and perfect gases); state diagrams. The principle of corresponding state; compressibility relations; reduced pressure; reduced volume; temperature; pseudo-critical constants. The ideal gas: specific heat, polytropic processes. Ideal gas cycles; Carnot; thermodynamic cycles, turbines, steam and gas, refrigeration. The first law of thermodynamics – heat and work, applications to open and closed systems. The steady flow energy equation (Bernoulli's equation) and application. Second law of thermodynamics, heat cycles and efficiencies.

GET 208: Strength of Materials (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. recognise a structural system that is stable and in equilibrium;
2. determine the stress-strain relation for single and composite members based on Hooke's law;
3. estimate the stresses and strains in single and composite members due to temperature changes;
4. evaluate the distribution of shear forces and bending moments in beams with distributed and concentrated loads;
5. determine bending stresses and their use in identifying slopes and deflections in beams;
6. use Mohr's circle to evaluate the normal and shear stresses in a multi-dimensional stress system and transformation of these stresses into strains;
7. evaluate the stresses and strains due to torsion on circular members; and
8. determine the buckling loads of columns under various fixity conditions at the ends.

Course Contents

Consideration of equilibrium; composite members, stress-strain relation. Generalised Hooke's law. Stresses and strains due to loading and temperature changes. Torsion of circular members. Shear force, bending moments and bending stresses in beams with symmetrical and combined loadings. Stress and strain transformation equations and Mohr’s circle. Elastic buckling of columns.

GET 209: Engineering Mathematics I (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:
1. solve qualitative problems based on vector and matrix analyses such as linear independence and dependence of vectors, rank etc;
2. describe the concepts of limit theory and nth order differential equations and their applications to physical phenomena;
3. solve the problems of differentiation of functions of two variables and know about the maximization and minimization of functions of several variables;
4. describe the applications of double and triple integration in finding the area and volume of engineering solids, and explain the qualitative applications of Gauss, Stoke’s and Green’s theorem;
5. explain ordinary differential equations and applications, and develop a mathematical model of linear differential equations, as well as appreciate the necessary and sufficient conditions for total differential equations; and

6. analyse basic engineering models through partial differential equations such as wave equation, heat conduction equation, etc., as well as fourier series, initial conditions and its applications to different engineering processes

Course Contents

Limits, continuity, differentiation, introduction to linear first order differential equations, partial and total derivatives, composite functions, matrices and determinants, vector algebra, vector calculus, directional derivatives.

GET 210: Engineering Mathematics II (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:
1. describe physical systems using ordinary differential equations (ODEs);
2. explain the practical importance of solving ODEs, solution methods, and analytically solve a wide range of ODEs, including linear constant coefficient types;
3. numerically solve differential equations using MATLAB and other emerging applications;

4. perform calculus operations on vector-valued functions, including derivatives, integrals, curvature, displacement, velocity, acceleration, and torsion, as well as on functions of several variables, including directional derivatives and multiple integrals;
5. solve problems using the fundamental theorem of line integrals, Green's theorem, the divergence theorem, and Stokes' theorem, and perform operations with complex numbers;
6. apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions of complex variables, as well as the theory of conformal mapping to solve problems from various fields of engineering; and
7. evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula.

Course Contents

Introduction to ordinary differential equations (ODEs); theory, applications, methods of solution; second order differential equations. Advanced topics in calculus (vectors and vector-valued function, line integral, multiple integral and their applications). Elementary complex analysis including functions of complex variables, limits and continuity. Derivatives, differentiation rules and differentiation of integrals. Cauchy-Riemann equation, harmonic functions, basic theory of conformal mapping, transformation and mapping and its applications to engineering problems. Special functions.

GET 211: Computing and Software Engineering (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of the course, the students should be able to:
1. describe and apply computing, software engineering knowledge, best practices, and standards appropriate for complex engineering software systems;
2. develop competence in designing, evaluating, and adapting software processes and software development tools to meet the needs of an advanced development project through practical object-oriented programming exposure taught in concrete terms with a specific modern language – preferable selected from Python, Java or C++;
3. use widely available libraries to prepare them for machine learning, graphics and design simulations;
4. develop skills in eliciting user needs and designing an effective software solution;

5. recognise human, security, social, and entrepreneurial issues and responsibilities relevant to engineering software and the digitalisation of services; and
6. acquire capabilities that can further be developed to make them productively employable by means of short Internet courses in specific areas;

Course Contents

Introduction to computers and computing; computer organisation – data processing, memory, registers and addressing schemes; Boolean algebra; floating-point arithmetic; representation of non-numeric information; problem-solving and algorithm development; coding (solution design using flowcharts and pseudo codes). Data models and data structures; computer software and operating system; computer operators and operators precedence; components of computer programs; introduction to object oriented, structured and visual programming; use of MATLAB in engineering applications. ICT fundamentals, Internet of Things (IoT). Elements of software engineering.

GET 299: Students Industrial Work Experience I (3 Units C: 9 weeks)

Learning Outcomes

SIWES I should provide opportunity for the students to:

1. acquire industrial workplace perceptions, ethics, health and safety consciousness, inter-personal skills and technical capabilities needed to give them a sound engineering foundation;
2. learn and practise basic engineering techniques and processes applicable to their specialisations;
3. build machines, devices, structures or facilities relevant to their specific engineering programmes and applications; and
4. acquire competence in technical documentation (log-book) and presentation (report) of their practical experiences.

Course Contents

Practical experience in a workshop or industrial production facility, construction site or special centres in the university environment, considered suitable for relevant practical/industrial working experience but not necessarily limited to the student's major. The students are exposed to hands-on activities on workshop safety and ethics, maintenance of tools, equipment and machines, welding, fabrication and foundry equipment, production of simple devices; electrical circuits, wiring and installation. (8-10 weeks during the long vacation following 200 level).

NOTE: **Each programme to indicate additional details of programme-specific activities for their students.**

BIU-GET **203 Engineering Graphics and Solid Modeling II** (2 Units; Core (C): LH 15; PH 45)

Senate-approved relevance

Engineering Graphics and Solid Modeling ensured the training of quality graduates who are highly skilled and knowledgeable in the computer graphics which is necessary to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Engineering Graphics and Solid Modeling from BIU being able to develop techniques that would enhance design analysis of engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Designers generally use drawings to represent objects that they design and to communicate the information to others. Of course, they will use other forms of representation as well, such as symbolic and mathematical models and possibly three-dimensional physical models—but drawing is arguably the most flexible and convenient of all.

Drawings are useful above all, obviously, for representing the geometrical form of the designed object and its appearance. Hence the importance in computer-aided design (CAD) of the production of visual images by computer, that is, computer graphics. In the process of design, technical drawings are used. Drawings explain the design and establish the link between design and manufacture. During the stage of design and detailing, it depends on the designers' skill and experience. Changes to previous designs take a long time because the drawings have to be produced again. Computer-aided drawing is a technique where engineering drawings are produced with the assistance of a computer and, as with manual drawing, is only a graphical means of representing a design.

Computer-aided design, however, is a technique where the attributes of the computer and those of the designer are blended together into a problem-solving team. When the term "CAD" is used to mean computer-aided design, it normally refers to a graphical system where components and assemblies can be modeled in three dimensions. The term "design," however, also covers those functions attributed to the areas of modeling and analysis. The acronym CADD is more commonly used nowadays and stands for computer-aided drafting and design. A CADD package is one that is able to provide all drafting facilities and some or all of those required for the design process. Two-dimensional (2D) computer drawing is the representation of an object in the single-view format, which shows two of the three object dimensions, or the multiview format, where each view reveals two dimensions. In both cases, the database includes just two values for each represented coordinate of the object. It can also be a pictorial representation if the database contains only X and Y coordinates.

Objectives

The objectives of the course are to:

1. apply general projection theory, with emphasis on orthographic projection;
2. represent three-dimensional objects in two-dimensional views;
3. represents letters and numbers in drawing sheet;
4. apply the different types of projection;
5. draw the projection of points, straight lines, solids etc;
6. draw the development of at least five different types of surfaces;
7. apply isometric projection in drawings;
8, explain the basics of dimensioning, lettering and representation of lines;
9. differentiate lines used for representation of different Engineering Sections;
10. apply the different types of angle of projection;
11. apply mastery of the use of projections to prepare detailed working drawing of objects and designs;
12. develop skills in parametric design to aid their ability to see design in the optimal specification of materials and systems to meet needs;
13. analyze and optimize designs on the basis of strength and material minimization;
14. apply the theoretical perspectives to create the basis for the analysis that are possible in design and optimization;
15. produce shop drawings for multi-physical, multidisciplinary design;
16. produce 3-D printing;
17. apply assembly drawing of a Plant.

Learning Outcomes

Students should be able to:

1. apply the two general projection theory, with emphasis on orthographic projection;
2. draw at least two examples of three-dimensional objects in two-dimensional views;
3. represents letters and numbers in drawing sheet;
4. apply at least one type of projection;
5. draw the projection of points, straight lines, solids etc;
6. draw the development of at least five different types of surfaces;
7. apply isometric projection in drawings and reproduce at least three drawings;
8, explain at least three basics of dimensioning, lettering and representation of lines;
9. differentiate using at least five types of lines used for representation of different Engineering Sections.
10. apply the two different types of angle of projection.

11. apply at least one mastery of the use of projections to prepare detailed working drawing of objects and designs;
12. develop at least three skills in parametric design to aid their ability to see design in the optimal specification of materials and systems to meet needs;
13. analyze and optimize designs on the basis of strength and material minimization;
14. apply at least two theoretical perspectives to create the basis for the analysis that are possible in design and optimization;
15. produce at least three shop drawings for multi-physical, multidisciplinary design.
16. produce at least two 3-D printing;
17. apply assembly drawing of a plant and create at least two.

Course Contents

Projection of lines, auxiliary views and mixed projection. Preparation of detailed working production drawing; semi-detailed drawings, conventional presentation methods. Solid, surface and shell modeling. Faces, bodies and surface intersections. Component-based design. Component assembly and motion constraints. Constrained motions and animation. Introduction to electronics modeling. Electronics board layout preparation, Component libraries and Schematic design. Parametric modeling and adaptive design. Simulation for material optimization. Designing for manufacturing. Additive and subtractive manufacturing. Production for 3-D printing, Laser cutting and CNC machinery. Arrangement of engineering components to form a working plant (Assembly Drawing of a Plant).

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities

BIU-GET **207 Applied Mechanics** (2 Units; Core (C): LH 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Applied Mechanics is necessary to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Applied Mechanics from BIU being able to develop techniques that would enhance mathematical analysis in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Engineering problems are generally tackled with applied mechanics through the application of theories of classical mechanics and fluid mechanics. Because applied mechanics can be applied in engineering disciplines like civil engineering, mechanical engineering, aerospace engineering, materials engineering, and biomedical engineering, it is sometimes referred to as engineering mechanics.

Science and engineering are interconnected with respect to applied mechanics, as researches in science are linked to research processes in civil, mechanical, aerospace, materials and biomedical engineering disciplines. In civil engineering, applied mechanics' concepts can be applied to structural design and a variety of engineering sub-topics like structural, coastal, geotechnical, construction, and earthquake engineering. In mechanical engineering, it can be applied in mechatronics and robotics, design and drafting, nanotechnology, machine elements, structural analysis, friction stir welding, and acoustical engineering.

In aerospace engineering, applied mechanics is used in aerodynamics, aerospace structural mechanics and propulsion, aircraft design and flight mechanics. In materials engineering, applied mechanics' concepts are used in thermo-elasticity, elasticity theory, fracture and failure mechanisms, structural design optimization, fracture and fatigue, active materials and composites, and computational mechanics. Research in applied mechanics can be directly linked to biomedical engineering areas of interest like orthopaedics; biomechanics; human body motion analysis; soft tissue modelling of muscles, tendons, ligaments, and cartilage; biofluid mechanics; and dynamic systems, performance enhancement, and optimal control,

Objectives

The objectives of the course are to:

1. explain basic concepts and system of forces;
2. describe the relationship of physical processes, kinetics and kinematics;
3. develop skills to use the basic principles of mechanics in engineering applications;
4. apply engineering design principles to produce solutions that meet specified needs of the society;
5.analyse using kinetic energy and momentum principles.
6. explain fundamental principles of applied mechanics, particularly equilibrium analysis, friction, kinematics and momentum;
7. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, mathematics and applied mechanics;
8. synthesize Newtonian Physics with static analysis;
9. determine the complete load impact (net forces, shears, torques, and bending moments) on all components (members and joints) of a given structure with a load;
10. apply engineering design principles to produce solutions that meet specified needs;
10. solve problems using kinetic energy and momentum principles.

Learning Outcomes

Students will acquire the ability to:

1. explain at least two basic concepts and system of forces;
2. describe the relationship of physical processes, kinetics and kinematics;
3. apply at least three the basic principles of mechanics in engineering applications;
4. apply at least two engineering design principles to produce solutions that meet specified needs of the society;
5. apply kinetic energy and momentum principles to solve at least two three problems;
6. explain at least two fundamental principles of applied mechanics, particularly equilibrium analysis, friction, kinematics and momentum;
7. identify, formulate, and solve at least three complex engineering problems by applying principles of engineering, science, mathematics and applied mechanics;
8. synthesize Newtonian Physics with static analysis and solve at least two examples;
9. determine the complete load impact (net forces, shears, torques, and bending moments) on all components (members and joints) of a given structure with a load;

10. apply at least three engineering design principles to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
11. solve at least three problems using kinetic energy and momentum principles.

Course Contents

Forces. Moments. couples. Equilibrium of simple structures. Equilibrium of machine parts. Friction. First and second moments of area. centroids. Kinematics of particles and rigid bodies in plane motion. Newton's laws of motion. Kinetic energy and momentum analyse. Forces and results. center of gravity. Equilibrium. straight line and rotating motion,.Newton's laws. Energy. moment of inertia. spin. Strength theory: Material testing. Tension. pressure and twisting. Bending, compound stresses.

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities.

300 Level

GST 312: Peace and Conflict Resolution (2 Units C: LH 30)

Learning Outcomes

At the end of this Course, students should be able to:
1. analyse the concepts of peace, conflict and security;
2. list major forms, types and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies; and
5. describe the roles of international organisations, media and traditional institutions in peace building.

Course Contents

The concepts of peace, conflict and security in a multi-ethnic nation. Types and theories of conflicts: ethnic, religious, economic, geo-political Conflicts; structural conflict theory, realist theory of conflict, frustration-aggression conflict theory; root causes of conflict and violence in Africa: indigene and settlers phenomenon, boundaries/boarder disputes, political disputes, ethnic disputes and rivalries, economic inequalities, social disputes, nationalist movements and agitations; selected conflict case studies – Tiv-Junkun, ZangoKartaf, chieftaincy and land disputes, etc. Peace building, management of conflicts and security: Peace & Human Development. Approaches to Peace & Conflict Management (religious, government, community leaders, etc.). Elements of peace studies and conflict resolution: Conflict dynamics assessment Scales: Constructive & Destructive. Justice and Legal framework: Concepts of Social Justice; The Nigeria Legal System. Insurgency and terrorism. Peace mediation and peace keeping. Peace and Security Council (international, national and local levels). Agents of conflict resolution – Conventions, Treaties Community Policing: Evolution and Imperatives. Alternative Dispute Resolution (ADR) (dialogue,. arbitration, negotiation, collaboration, etc). The roles of international organizations in conflict resolution ((a) The United Nations, UN and its conflict resolution organs. (b) The African Union & Peace Security Council (c) ECOWAS in peace keeping). The media and traditional institutions in peace building. Managing post-conflict situations/crises: Refugees. Internally Displaced Persons (IDPs);the role of NGOs in post-conflict situations/crises.

ENT 312: Venture Creation (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students, through case study and practical approaches, should be able to:

1. describe the key steps in venture creation;
2. spot opportunities in problems and in high potential sectors, regardless of geographical location;
3. state how original products, ideas and concepts are developed;
4. develop a business concept for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;
6. implement the requirements for establishing and managing micro and small enterprises;
7. conduct entrepreneurial marketing and e-commerce;
8. apply a wide variety of emerging technological solutions to entrepreneurship; and
9. appreciate why ventures fail due to lack of planning and poor implementation.

Course Contents

Opportunity identification (sources of business opportunities in Nigeria, environmental scanning, demand and supply gap/unmet needs/market gaps/market research, unutilised resources, social and climate conditions and technology adoption gap). New business development (business planning, market research). Entrepreneurial finance (venture capital, equity finance, micro-finance, personal savings, small business investment organizations and business plan competition). Entrepreneurial marketing and e-commerce (principles of marketing, customer acquisition & retention, B2B, C2C and B2C models of e-commerce, First Mover Advantage, E-commerce business models and successful e-commerce companies). Small business management/family business: Leadership & Management, basic book keeping, nature of family business and family business growth model. Negotiation and business communication (strategy and tactics of negotiation/bargaining, traditional andmodern business communication methods). Opportunity discovery demonstrations (business idea generation presentations, business idea contest, brainstorming sessions, idea pitching). Technological solutions (The concept of market/customer solution, customer solution and emerging technologies, business applications of new technologies - artificial intelligence (AI), virtual/mixed reality (VR), Internet of things (IoTs), blockchain, cloud computing, renewable energy, etc. Digital business and e-commerce strategies).

GET 301: Engineering Mathematics III (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. demonstrate a clear understanding of the course content, that is, possess a breadth of knowledge in the area covered;
2. possess an in-depth knowledge upon which a solid foundation can be built in order to demonstrate a depth of understanding in advanced mathematical topics;
3. develop simple algorithms and use computational proficiency;
4. write simple proofs for theorems and their applications; and
5. communicate the acquired mathematical knowledge effectively in speech, writing and collaborative groups.

Course Contents

Linear Algebra. Tensor algebra and analysis, Elements of Matrices, Determinants, Inverses of Matrices, bases representation of tensors. The Euclidean point space and vector spaces. Theory of

Linear Equations. Eigen Values and Eigen Vectors. Analytical Geometry. Basic transformations: identity, spherical, Projection and Coordinate Transformation as tensors, Traces, Determinants and other scalar invariants. Equivalent stresses and strains as examples of scalar invariant. Applications to design, analyses and optimization. Elgenvalues, Elgeanvectors of tensors. Solid Geometry. Polar, cylindrical and spherical coordinates. Elements of functions of several variables. Surface Variables. Ordinary Integrals. Evaluation of Double Integrals, Triple Integrals, Line Integrals and Surface Integrals. Derivation and Integrals of Vectors. The gradient of scalar and fiels. Flux of Vectors. The curl of a vector field, Gauss, Greens and Stoke's theorems and applications: Determinations and applications to field equations in linear abd nonlinear mechanics. Singular Valued Functions. Multivalued Functions. Analytical Functions. Cauchy Riemann's Equations. Singularities and Zeroes. Contour Integration including the use of Cauchy's Integral Theorems. Bilinear transformation.

GET 302: Engineering Mathematics IV (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. solve second order differential equations;
2. solve partial differential equations;
3. solve linear integral equations;
4. relate integral transforms to solution of differential and integral equations;
5. explain and apply interpolation formulas; and
6. apply Runge-Kutta and other similar methods in solving ODE and PDEs.

Course Contents

Series solution of second order linear differential equations with variable coefficients. Bessel and Legendre equations. Equations with variable coefficients. Sturn-Louville boundary value problems. Solutions of equations in two and three dimensions by separation of variables. Eigen value problems. Use of operations in the solution of partial differential equations and Linear integral equations. Integral transforms and their inverse including Fourier, Laplace, Mellin and Handel Transforms. Convolution integrals and Hilbert Transforms. Calculus of finite differences. Interpolation formulae. Finite difference equations. RungeKutta and other methods in the solutions of ODE and PDEs. Numerical integration and differentiation.

GET 304: Technical Writing and Communication (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the student should be able to:

1. demonstrate the concept of clear writing, common pitfalls and unambiguous language in engineering communication, including technical reporting for different applications and emotional comportment;
2. demonstrate the skills of language flexibility, formatting, logic, data presentation styles, referencing, use of available aids, intellectual property rights, their protection, and problems in engineering communication and presentation; and
3. demonstrate good interpersonal communication skills through hands-on and constant practice on real-life communication issues for engineers in different sociocultural milieu for engineering designs, structural failure scenarios and presentation of reports.

Course Contents

A brief review of common pitfalls in writing. Principles of clear writing (punctuations and capitalization). Figures of speech. Units of grammar. Tenses and verb agreement. Active and passive sentences Lexis and structure Fog Index concept. Skills for communication and communication algorithm. Types and goals of communication; Interpersonal communication; features and the Finger Model or A,B,C,D,E of good interpersonal communication (accuracy of technical terms, brevity of expression, clarity of purpose, directness of focus and effectiveness of the report). Language and organisation of reports. Technical report writing skills (steps, problems in writing, distinguishing technical and other reports, significance, format and styles of writing technical reports). Different formats for communication; styles of correspondences – business report and proposal, business letter, memorandum, e-mails, etc. Proposals for projects and research; format, major steps and tips of grant-oriented proposals. Research reports (competency, major steps, components and formats of research reports and publishable communication). Sources and handling of data, tables, figures, equations and references in a report. Presentation skills; overview, tips, organisation, use of visual aids and practising of presentation. Intellectual property rights in research reports. Case studies of major engineering designs, proposals and industrial failures with professional presentation of reports.

GET 305: Engineering Statistics and Data Analytics (3 Units C: LH 45)

Learning Outcomes

At the end of the course, the students should be able to:

1. work with data from the point of view of knowledge convergence, machine learning, and intelligence augmentation, which significantly raises their standard for engineering analysis (the approach forces them to learn statistics in an actionable way that helps them to see the holistic importance of data analytics in modern engineering and technology);
2. anticipate the future with Artificial Intelligence while fulfilling the basic requirements of conventional engineering statistical programming consistent with their future careers;
3. perform, with proficiency, statistical inference tasks with language or programming toolboxes such as R, Python, Mathematica or MATLAB, and Design Expert to summarise the analysis and interpretation of engineering data from industry, and make appropriate conclusions based on such experimental and/or real-life industrial data;
4. construct appropriate graphical displays of data and highlight the roles of such displays in data analysis, particularly the use of statistical software packages;
5. plan and execute experimental programmes to determine the performance of programme-relevant industrial engineering systems, and evaluate the accuracy of the measurements undertaken; and
6. demonstrate mastery of data analytics and statistical concepts by communicating the results of experimental and industry-case investigations, critically reasoned scientific and professional analysis through written and oral presentation.

Course Contents

Descriptive statistics, frequency distribution, populations and sample, central tendency, variance data sampling, mean, median, mode, mean deviation, percentiles, etc. Probability. Binomial, Poisson hyper-geometric, normal distributions, etc. Statistical inference intervals, test hypothesis and significance. Regression and correlation. Introduction to big data analytics and cloud computing applications. Introduction to the R language; R as a calculator; Vectors, matrices, factors, data frames and other R collections. Iteration and looping control structures. Conditionals and other controls. Designing, using and extending functions. The Apply Family. Statistical modelling and inference in R.

GET 307: Introduction to Artificial Intelligence, Machine Learning and Convergent Technologies (3 Units C: LH 45)

Learning Outcomes

At the completion of the course, the students are expected to be able:

1. explain the meaning, purpose, scope, stages, applications and effects of artificial intelligence;
2. explain the fundamental concepts of machine learning, deep learning and convergent technologies;
3. demonstrate the difference between supervised, semi-supervised and unsupervised learning;
4. demonstrate proficiency in machine learning workflow and how to implement the steps effectively;
5. explain natural languages, knowledge representation, expert systems and pattern recognition;
6. describe distributed systems, data and information security and intelligent web technologies;
7. explain the concept of big data analytics, purpose of studying it, issues that can arise with a data set and the importance of properly preparing data prior to a machine learning exercise; and
8. explain the concepts, characteristics, models and benefits, key security and compliance challenges of cloud computing.

Course Contents

Concepts of human and artificial intelligence; artificial/computational intelligence paradigms; search, logic and learning algorithms. Machine learning and nature-inspired algorithms – examples, their variants and applications to solving engineering problems; understanding natural languages; knowledge representation, knowledge elicitation, mathematical and logic foundations of AI; expert systems, automated reasoning and pattern recognition; distributed systems; data and information security; intelligent web technologies; convergenttechnologies – definition, significance and engineering applications. Neural networks and deep learning. Introduction to python AI libraries.

GET 399: Students Industrial Work Experience II (4 Units C: 12 weeks)

Learning Outcomes

At the end of the SIWES, students should be able to:

1. demonstrate proficiency in at least any three softwares in their chosen career choices;
2. demonstrate proficiency in some animation videos (some of which are free on YouTube) in their chosen careers;
3. carry out outdoor hands-on construction activities to sharpen their skills in their chosen careers;
4. demonstrate proficiency in generating data from laboratory analysis and develop empirical models;
5. demonstrate proficiency in how to write engineering reports from lab work;
6. fill logbooks of all experience gained in their chosen careers; and
7. write a general report at the end of the training.

***The experience is to be graded and the students must pass all the modules of the attachment and shall form part of CGPA.**

Course Contents

On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student’s major (Students are to proceed on three months of work experience i.e. 12 weeks during the long vacation following 300 level). Students are engaged in the more advanced workshops, indoor software design training similar to what they will use in the industry and outdoor construction activities to sharpen their skills. The use of relevant animation videos that mimic industrial scenarios is encouraged. Students are to write a report at the end of the training. As much as possible, students should be assisted and encouraged to secure 3 months placement in the industry. Examples of outline of activities and experiences to which students are expected to be exposed to earn prescribed credits include:

Section A: Welding and fabrication processes, automobile repairs, · lathe machine operations: machining and turning of simple machine elements, such as screw threads, bolts, gears, etc. Simple milling machine operations, machine tool maintenance and trouble-shooting, andwooden furniture making processes.

Section B: Mechanical design with computer graphics and CAD modelling and drafting. Introduction to Solidworks: software capabilities, design methodologies and applications. Basics part modelling: sketching with SolidWorks, building 3D components, using extruded Bose base · Basic assembly modelling, and solidWorks drawing drafting. Top-down assembly technique exploded view, exploded line sketch. Introduction to PDMS 3D design software; autoCAD mechanical, SPSS. A comprehensive case study design project. The student should be introduced to the concept of product/component design and innovation and then be given a comprehensive design project.

Examples of projects should include the following:

a. design of machine components;

b. product design and innovation;

c. part modelling and drafting in solidworks; and

d. technical report writing.

MEE 301: Computer-Aided Design and Manufacture (3 Units C: LH 30; PH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. visualise and apply basic drafting fundamentals;
2. prepare and edit engineering drawings;
3. explain the concepts and underlying theory of modelling and the usage of models in different engineering applications;
4. compare the different types of modelling techniques and explain the central role solid models play in the successful completion of CAD/CAM-based product development;
5. produce CAD drawings (create accurate and precise geometry of complex engineering systems and use the geometric models in different engineering applications);
6. use and assess commercial CAD/CAM tools efficiently, effectively and intelligently in selected engineering applications;
7. take active role in product design and development process as well as prototyping;
8. model 3D part and assemblies using SolidWorks program (or alternative CAD software);
9. analyse the part design using one of the computational methods (e.g. stress analysis) - calculate part features using math skills;
10. demonstrate proficiency in the concepts of computer-aided manufacturing and a number of applied associated processes; and
11. explain the basic concepts of CNC programming and machining.

Course Contents

Introduction to computer aided design (CAD)**.** Basic data structuring technique**.** Computer graphics**.** Geometric transformation techniques. Mathematical bases for surface modeling: curves, surfaces and solids**.** Principles of solid modeling and application**.** CAD software**.** Introduction to CAM: Relation between production volume and flexibility. Various manufacturing systems – batch, mass, group, cellular and flexible manufacturing systems. Type of automation and benefits of soft or flexible automation**.** Automation in material handling and assembly**.** CNC machines: Introduction, classification, design and control features including interpolations**.** Numerical control and NC part-programming**.** Introduction to Robotics: Definitions, motivation, historical development. Basic structure, classification, workspace, drives, controls, sensors, grippers, specifications. Manual CNC programming (milling and turning). Basic and advanced CAD/CAM for CNC (milling and turning). Group project assignment.

BIU-MEE **305 Mechanics of Machines I**, (2 Units; Core (C); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Mechanics of Machines to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Mechanics of Machines from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Engineering Mechanics provides the "building blocks" of statics, dynamics, strength of materials, and fluid dynamics. Engineering mechanics is the discipline devoted to the solution of mechanics problems through the integrated application of mathematical, scientific, and engineering principles. Mechanics of machine is defined as a science that concerned with the motion of bodies under the action of forces, including the special case in which a body remains at rest. Of first concern in the problem of motion are the forces that bodies exert on one another. This leads to the study of such topics as gravitation, electricity, and magnetism, according to the nature of the forces involved. Given the forces, one can seek the manner in which bodies move under the action of forces; this is the subject matter of mechanics proper.

Mechanics may be divided into three branches: statics, which deals with forces acting on and in a body at rest; kinematics, which describes the possible motions of a body or system of bodies; and kinetics, which attempts to explain or predict the motion that will occur in a given situation. Alternatively, mechanics may be divided according to the kind of system studied. The simplest mechanical system is the particle, defined as a body so small that its shape and internal structure are of no consequence in the given problem. More complicated is the motion of a system of two or more particles that exert forces on one another and possibly undergo forces exerted by bodies outside of the system.

Objectives

The objectives of the course are to:
1. explain the basic principles of kinematics and motion;
2. explain mechanisms or linkages, displacement, motion and instantaneous centers;
3. analyse the relative velocities and accelerations in mechanisms;
4. analyse the rolling and sliding contact;
5. solve problems on cam, gear and gearing;
6. apply the analytical and graphical methods in the computation and analysis of mechanisms.

Learning outcomes

At the end of this course, students should be able to:
1. explain at least five basic principles of kinematics and motion;
2. explain least five mechanisms or linkages, displacement, motion and instantaneous centers;

3. analyse the relative velocities and accelerations in mechanisms;
4. analyse at least five rolling and sliding contact;
5. solve at least five (5) problems on cam, gear and gearing;
6. apply the analytical and graphical methods in the computation and analysis of mechanisms of at least three selected problems.

Course Contents

Basic principles of kinematics. Basic principles motion. Mechanisms or linkages. Displacement. motion and instantaneous centers. Relative velocities. accelerations in mechanisms. Rolling contact. sliding contact. Cams. Gear and gearing. Gear trains. Introduction to analytical. and graphical methods in the computation, and analysis of mechanisms.

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities

BIU-GET 314 Engineering Economics (2 Units; Core (C): LH=30)

Senate-Approved Relevance

The course is designed to fulfill the application of economics principles in the Engineering practice. Engineering Economics is a collection of mathematical techniques which simplify economic comparison to evaluate the economic aspects of different methods to accomplish a set objective. In keeping with the University desire to produce excellent professionals, the course is designed to equip the students with the economic knowledge to evaluate Engineering projects in Nigeria.

Overview

Efficient function of any business organization would enable it to provide goods and services at an economic price. In the process of managing organization, the managers at different levels should take appropriate economic decision which will help in optimising investment, operating and maintenance expenditures besides increasing the revenue, savings and such other gains of the organization. These can be achieved through the course, Engineering Economics which deals with the methods that enable one to make economic decision towards minimizing cost and /or maximizing benefit to the business organization.

The Institutional additional course BIU-GET 314, Engineering Economics is designed to teach basic economic principles, financial management and accounting. The course cuts across all Engineering Programmes.

Course Objective

This course intends to:
1. define and explain the importance of engineering economics;
2. explain the theories of interest, annuities and profit;
3. apply Break-Even analysis as a decision-making tool;
4. list and explain the accounting methods;
5. explain budget and budgetary control as tools for management planning;
6. explain the element of cost; direct and indirect expenses, depreciation and replacement;
7. explain the methods of capital financing and Investment;
8. discuss the need for value engineering in project management.

Learning Outcomes

On completion of the course, the students should be able to:

1. define and explain at least five importance of engineering economics;
2. explain the theories of interest, annuities and profit;
3. apply Break-Even analysis as a decision-making tool;
4. list and explain at least five (5) accounting methods;
5. explain budget and budgetary control as tools for management planning;
6. explain the element of cost; direct and indirect expenses, depreciation and replacement;
7. explain at least three methods of capital financing and Investment;
8. discuss the need for value engineering in project management.

Course Content

Definition of Engineering Economy. Interest. Annuities. Sinking fund and profit. Break-Even analysis. Financial management. Accounting methods. Book keeping and balance sheet. Profit and loss statement. Cost planning and control. Budget and budgetary control. Element of cost. Indirect expenses, depreciation and replacement. Accounting, Valuation of Asset and capital financing. Investment. Value Engineering.

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities

BIU-MEE 307: Engineering Thermodynamics II, (2 Units; Core (C); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in Engineering thermodynamics to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU’s mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Engineering Thermodynamics from BIU being able to develop techniques that would enhance the application of heat in the design and redesign of engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Thermodynamics is the science of heat as a special form of energy exchange. It is thus a branch of energetics, the general science of the forms and interchanges of energy. From a thermodynamic standpoint, energy can be exchanged in two fundamental ways: in the form of work or in the form of heat.

Transcend in the study of thermodynamics enabled the optimization of industrial processes, especially in the industrial field where there are boilers, turbines, evaporators, condensers, cooling towers, and large-scale combustion processes. The knowledge and application of laws of thermodynamics improves these processes, which in turn infer in the improvement of production systems. The mechanical engineer as a designer, supervisor and evaluator of various projects that involve maintenance must have clear knowledge and application in thermodynamics.

Objectives
The objectives of the course are to:
At the end of this course, students should be able to:
1. explain the thermodynamic Properties of Pure Substances. ;
2. solve problems on perfect gas, specific and latent heats;
3. explain the Phases of pure substances;
4. determine the Phases of Equilibria and changes in critical point,;
5. solve problems on Heat and Work Transfer using First law of thermodynamics.;
6. apply general energy equation and Bernoulli's equation;
7. solve problems in Engine cycles, air- standard cycle, Otto-cycle, simple gas turbine cycle, Carnot cycle and heat pump;
8. apply the Second law of thermodynamics and entropy irreversibility.

Learning outcomes
At the end of this course, students should be able to:
1. explain at least four thermodynamic Properties of Pure Substances. ;
2. solve at least three calculation problems on perfect gas, specific and latent heats;
3. explain at least two Phases of pure substances;
4. determine the Phases of Equilibria and changes in critical point,
5. solve at least five problems on Heat and Work Transfer using First law of thermodynamics.;
6. solve at least three problems using general energy equation and Bernoulli's equation;
7. solve at least three problems each in Engine cycles, air- standard cycle, Otto-cycle, simple gas turbine cycle, Carnot cycle and heat pump;
8. solve at least three problems using the Second law of thermodynamics and entropy irreversibility.

Course Contents
Systems. stages. property. interactions. equilibrium. Cycle. point and path functions temperature. etc. Thermodynamic Properties of Pure Substances. Perfect gas. specific and latent heats. equations of state. Phases of pure substances; solids, liquids and gases. Phases Equilibria and changes in critical point. properties of vapours. use of thermodynamics tables. Heat and Work Transfer: First law of thermodynamics. general energy equation and Bernoulli's equation. Engine cycles. air- standard cycle. Otto-cycle. simple gas turbine cycle. Carnot cycle. heat pump. etc. Second law of thermodynamics. entropy irreversibility.

Minimum Academic Standards
In accordance with the NUC- MAS requirement facilities

BIU-MEE **310 Laboratory Practice I**, (2 Units; Core (C); LH = 15, PH = 45)
Senate-approved relevance
Training of quality graduates who are highly skilled and knowledgeable in the Laboratory Practice to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering Laboratory Practice from BIU being able to develop

techniques that would enhance engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

One of the fundamental purposes of the Principles of Good Laboratory Practice (GLP) is to ensure the quality and integrity of test data related to engineering. The way in which study data, supporting human, animal and environmental safety assessment, is generated, handled, reported, retained and archived has continued to evolve in line with the introduction and ongoing development of supporting technologies. However, the main purpose of the requirements of the Principles of GLP remains the same in having confidence in the quality, the integrity of the data and being able to reconstruct activities performed during the conduct of engineering laboratory test.

The function of the engineering profession is to manipulate materials, energy, and information, thereby creating benefit for humankind. To do this successfully, engineers must have a knowledge of nature that goes beyond mere theory—knowledge that is traditionally gained in educational laboratories. Over the years, however, the nature of these laboratories has changed leading to the development of new engineering laboratory facilities.

Objectives

The objectives of the course are to:

1. discuss the laboratory procedure and methods for engineering materials;
2. discuss the principles and different methods of hardness measurement;
3. discuss the correlations among different types of hardness measurement and correlations of hardness with tensile strength;
4. apply the types of hardness testers;
5. apply computer-controlled universal testing machine (UTM) to perform standard tensile test and test procedure;
6. analyse the tensile behaviour of metal and polymer materials;
7. discuss at least two material properties from stress-strain curves obtained from tensile tests;
8. explain at least two methods for toughness measurement with impact tests;
9. describe at least three heat treatment principles and methods.
10. Investigate the operation and performance of a refrigerator;
11. Investigate the convection heat transfer;
12. apply automotive test bed in an experiment;
13. analyse the treatment and microscopic examination of steels.

Learning outcomes

At the end of this course, students should be able to:

1. discuss at least five laboratory procedure and methods for engineering materials;
2. discuss at least three principles and different methods of hardness measurement;
3. discuss the correlations among different types of hardness measurement and correlations of hardness with tensile strength;
4. apply at least two types of hardness testers;
5. apply computer-controlled universal testing machine (UTM) to perform standard tensile test and test procedure;
6. analyse the tensile behaviour of metal and polymer materials;

7. discuss at least two material properties from stress-strain curves obtained from tensile tests;
8. explain at least two methods for toughness measurement with impact tests;
9. describe at least three heat treatment principles and methods;
10. Investigate at two operation and performance of a refrigerator;
11. Investigation at least two examples of convection heat transfer;
12. apply at least one automotive test bed in an experiment;
13. analyse the treatment and microscopic examination of steels.

Course Contents

Laboratory investigations. and report submission on selected experiments. and projects drawn from introduction. to applied mechanics. thermodynamics. materials science. workshop technology courses. working with Resistors. and Diodes. Bridge Circuits. Oscilloscopes. and Capacitors. Relays. Transistors. Fluid Mechanics experiments. Strength of Materials experiments. Investigation of whirling of the shafts. Investigation of journal friction. Investigation of the operation and performance of a refrigerator. Experiment on air-conditioning unit. Refrigerator plant test. Experiment on conduction heat transfer. Investigation of convection heat transfer. Automotive test bed. Treatment and microscopic examination of steels. Brinell hardness test.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE **313 Laboratory Practice II**, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Laboratory Practice to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering Laboratory Practice from BIU being able to develop techniques that would enhance engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Assuring the quality and integrity of test data related to engineering is one of the primary goals of the Principles of Good Laboratory Practice (GLP). With the advent and ongoing advancement of assisting technologies, the generation, handling, reporting, retention, and archiving of study data supporting human, animal, and environmental safety assessment has continued to change. Nonetheless, maintaining confidence in the accuracy and reliability of the data and being able to retrace actions taken during the conduct of engineering laboratory tests continue to be the main goals of the GLP criteria.

Engineering is a career that deals with manipulating materials, energy, and information to benefit humanity. Engineers must possess a thorough understanding of nature; a knowledge that is typically acquired in educational laboratories—in order to accomplish this successfully. Yet, as time went on, these laboratories' characteristics altered, which prompted the creation of brand-new engineering laboratory facilities.

Objectives

The objectives of the course are to:

1. discuss the correlations among different types of hardness measurement and correlations of hardness with tensile strength;
2. apply the types of hardness testers;
3. apply computer-controlled universal testing machine (UTM) to perform standard tensile test and test procedure;
4. investigate the tensile behaviour of metal and polymer materials,
5. explain material properties from stress-strain curves obtained from tensile tests and methods for toughness measurement with impact tests;
6. describe the heat treatment principles and methods; and

Learning outcomes

At the end of this course, students should be able to:

1. discuss at least five laboratory procedure and methods for engineering materials;
2. discuss at least three principles and different methods of hardness measurement;
3. discuss the correlations among different types of hardness measurement and correlations of hardness with tensile strength;
4. apply at least two types of hardness testers;
5. apply computer-controlled universal testing machine (UTM) to perform standard tensile test and test procedure;
6. observe the tensile behaviour of metal and polymer materials,
7. explain material properties from stress-strain curves obtained from tensile tests and methods for toughness measurement with impact tests;
8. describe at least three heat treatment principles and methods.

Course Contents

Laboratory investigations. and report submission on selected experiments. and report submission on selected projects drawn from introduction to applied mechanics. Thermodynamics. materials science. and workshop technology courses. working with Resistors. and Diodes. Bridge circuits. Oscilloscopes. Capacitors. Relays. and Transistors. Fluid Mechanics experiments. Strength of Materials experiments. Workshop setting. Types of workshop equipment. machines and materials. Use of instruments and tools. Machine operation practice. Safety procedures in workshops.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 309: Manufacturing and Production Technology, (2 Units; Elective (E); LH = 15; LH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Manufacturing and Production Technology to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Manufacturing and Production

Technology from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Materials are the driving force behind the technological revolutions and are the key ingredients for manufacturing. Materials are everywhere around us, and we use them in one way or the other. The materials and the manufacturing process employed, could be better appreciated if one understands various types of materials and its properties. The 'driving force' behind a 'technological revolution' has always been a certain 'material'.
There would have been no 'industrial revolution' without 'steel' and no 'electronic/computer revolution' without 'semiconductor'. Similarly, the 'key' behind 'socioeconomic development' is the 'manufacturing' which is done by certain manufacturing processes using certain materials. Moreover, the primary duty of engineers is to make life-style of people easier and more comfortable, engineers do this by 'making' certain tools and things through certain manufacturing processes using certain material of desirable property.

Manufacturing technologies drive the production process and get products out in a much more efficient manner. This is associated to machines automating the process, in which production time is drastically reduced between product batches, ultimately allowing for the manufacturing operation to increase profits

Objectives

The objectives of the course are to:
1. identify the types workshop in engineering organization;
2. state the types of manufacturing processes and their uses;
3. describe the common machines and tools used in manufacturing process;
4. explain the operations and capabilities of machines used in manufacturing;
5. identify the engineering materials, their types, uses and properties;
6. state the safety rules and regulations in the workshop and state their obligations in ensuring safety;
7. explain the parts of Lathe accessories and attachments, drilling machines, drill bits and their uses;
8. describe the simple metal cutting applied to hand tool and single point tool geometry;
9. identify the cutting fluid and state the general principles of working metal cutting machine tools.

Learning outcomes

At the end of this course, students should be able to:
1. identify at least three types workshop in engineering organization;
2. state at least five types of manufacturing processes and their uses;
3. describe at least five common machines and tools used in manufacturing process;
4. explain the operations and capabilities of machines used in manufacturing;
5. identify at least five (5) engineering materials, their types, uses and properties;
6. state at least five safety rules and regulations in the workshop and state their obligations in ensuring safety;
7. explain at least five parts of Lathe accessories and attachments, drilling machines, drill bits and their uses;

8. describe at least two simple metal cutting applied to hand tool and single point tool geometry;
9. identify at least three cutting fluid and state the general principles of working metal cutting machine tools.

Course Contents

Introduction to types and organization of engineering workshops covering jobbing, batch, mass production. Engineering materials: Their uses and properties. Safety in workshops and general principles of working. Bench work and fitting: Hand tools, instruments. Carpentry: Hand tools. Materials. types of joint. processing of timber. Blacksmithing, and tools and working principles. Joints and fastenings: threaded fasteners. riveting, welding, brazing, and soldering. Measurement and marking out for uniformity. circularity, concentricity, etc. Standard measuring tools used in the workshop. Simple metal cutting applied to hand tools. Single point tool geometry. Cutting fluid General principles of working of standard metal cutting machine tools. Work and tool movement, speed and feed range. Centre lathe operations: Straight/taper turning. Thread cutting. Parts of lathes accessories and attachments used on centre lathe. Drilling machine, drill bits and uses.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 312: Machine Design I, (2 Units; Elective (E); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Machine Design to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Machine Design from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Machine is a combination of linkages having definite motion and capable of performing useful work. Machine Design is creation of plans for the machine to perform the desired functions. Machine design can be defined as creation of right combination of correctly proportioned moving and stationary components so constructed and joined as to enable the liberation, transformation and utilization of energy.

Scientific principles, technical knowledge and imagination are used to develop a machine or mechanical system to perform specific functions with maximum economy and efficiency. It includes the creation of new better machines or improving the existing ones. Machine Design requires the knowledge of basic and engineering sciences such as Physics, Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Thermodynamics and Heat Transfer, Vibrations, Fluid Mechanics, Metallurgy, Manufacturing Processes and Engineering Drawing.

Objectives

The objectives of the course are to:
1. explain the fundamental background of machine design;
2. discuss the Philosophy of machine design;
3. apply codes, charts, tables, standards and empirical data in engineering design;
4. solve some design problem;
5. provide justification detailed design (quantitative and qualitative);
6. list the engineering materials in design and make presentations of design drawing for manufactured machine;
7. apply stress and deflection analysis;
8. discuss the design against failure and power screws.

Learning outcomes

1. explain the fundamental background of machine design;
2. discuss the Philosophy of machine design;
3. apply codes, charts, tables, standards and empirical data in engineering design;
4. solve at least five design problem;
5. provide justification detailed design (quantitative and qualitative);
6. list at least five engineering materials in design and make presentations of design drawing for manufactured machine;
7. apply stress and deflection analysis to solve at least three problems;
8. describe the design against failure and power screws.

Course Contents

Fundamental background of machine design. Philosophy of machine design. Use of codes. Charts. tables. Standards and empirical data in engineering design. Design as a problem solving. components of design. design specifications; basis. justification detailed design (quantitative and qualitative). Engineering materials in design. and presentations of design drawing for manufacture. Stress and deflection analysis, Design against failure. power screws. Detachable fasteners. Shafting design.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE **311: Mechanics of Machines II**, (2 Units; Elective (E); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Mechanics of Machines to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU’s mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Mechanics of Machines from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Engineering Mechanics provides the "building blocks" of statics, dynamics, strength of materials, and fluid dynamics. Engineering mechanics is the discipline devoted to the solution of mechanics problems through the integrated application of mathematical, scientific, and engineering principles.

Mechanics of machine is defined as a science that concerned with the motion of bodies under the action of forces, including the special case in which a body remains at rest. Of first concern in the problem of motion are the forces that bodies exert on one another. This leads to the study of such topics as gravitation, electricity, and magnetism, according to the nature of the forces involved. Given the forces, one can seek the manner in which bodies move under the action of forces; this is the subject matter of mechanics proper.

Mechanics may be divided into three branches: statics, which deals with forces acting on and in a body at rest; kinematics, which describes the possible motions of a body or system of bodies; and kinetics, which attempts to explain or predict the motion that will occur in a given situation. Alternatively, mechanics may be divided according to the kind of system studied. The simplest mechanical system is the particle, defined as a body so small that its shape and internal structure are of no consequence in the given problem. More complicated is the motion of a system of two or more particles that exert forces on one another and possibly undergo forces exerted by bodies outside of the system.

Objectives

The objectives of the course are to:

1. analyse Static and Inertia force in machines;
2. analyse the dynamically equivalent systems;
3. explain and solve problems on balancing of rotating and reciprocating masses;
4. draw the turning moment diagrams;
5. solve problems on flywheels, Governors, Gyroscopic and motion and forces;
6. analyse free and forced vibrations;
7. analyse friction in machines (e.g. bearing, clutches, etc).

Learning outcomes

At the end of this course, students should be able to:

1. analyse Static and Inertia force in machines and solve at least two problems;
2. analyse the dynamically equivalent systems and solve at least three problems;
3. explain and solve at least five calculation problems on balancing of rotating and reciprocating masses;
4. draw at least three turning moment diagrams;
5. solve at least five calculation problems each on flywheels, Governors, Gyroscopic and motion and forces;
6. analyse free and forced vibrations and solve at least three problems;
7. analyse friction in machines (e.g. bearing, clutches, etc) and solve at least three problems.

Course Contents

Static and Inertia force analysis in machines. Dynamically equivalent systems. Balancing of rotating. reciprocating masses. Turning moment diagrams. and flywheels. Governors, Gyroscopic motion. and forces. Free and forced vibrations. Friction in machines (e.g. bearing, clutches, etc).

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities

BIU-MEE 308: Fluid Mechanics II, (2 Units; Elective (E); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the fluid mechanic to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering fluid mechanics from BIU being able to develop techniques that would enhance proper understanding of fluid flow in oil and gas sector of engineering facilities and in other public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Fluid mechanics is the branch of physics concerned with the mechanics of fluids (liquids, gases, and plasmas) and the forces on them. It has applications in a wide range of disciplines, including mechanical, aerospace, civil, chemical and biomedical engineering, geophysics, oceanography, meteorology, astrophysics, and biology. It can be divided into fluid statics, the study of fluids at rest; and fluid dynamics, the study of the effect of forces on fluid motion. It is a branch of continuum mechanics, a subject which models matter without using the information that it is made out of atoms; that is, it models matter from a macroscopic viewpoint rather than from microscopic.

Fluid mechanics, especially fluid dynamics, is an active field of research, typically mathematically complex. Many problems are partly or wholly unsolved and are best addressed by numerical methods, typically using computers. A modern discipline, called computational fluid dynamics (CFD), is devoted to this approach. Particle image velocimetry, an experimental method for visualizing and analyzing fluid flow, also takes advantage of the highly visual nature of fluid flow.

Objectives

The objectives of the course are to:

1. explain the nature and types of fluid;
2. explain the Physical properties of fluid mechanics;
3. analyse fluid at rest;
4. determine the effect of various instruments, (valves, orifices, bends and elbows) on fluid flow in pipes;
5. measure the flow parameters with venturi meters, orifice meters, weirs;
6. solve problems based on principles of mass, momentum and energy conservation;
7. perform dimensional analysis and simple fluid modelling problems;
8. specify the type and capacity of pumps and turbines for engineering applications;

9. apply the the Pi-Theorem to solve problems;
10. solve problems using the dynamic similarity and models.

Learning outcomes

At the end of this course, students should be able to:
1. explain the nature and at least three types of fluid;
2. explain at least three Physical properties of fluid mechanics;
3. analyse fluid at rest and solve at least three problems;
4. determine the effect of various instruments, (valves, orifices, bends and elbows) on fluid flow in pipes;
5. measure at least three flow parameters with venturi meters, orifice meters, weirs;
6. solve at least three calculations each based on principles of mass, momentum and energy conservation;
7. perform dimensional analysis and simple fluid modelling problems;
8. specify the type and capacity of at least three pumps and turbines for engineering applications;
9. apply the the Pi-Theorem to solve at least three problems;
10. solve at least three problems using the dynamic similarity and models.

Course Contents

Introduction, nature and types of fluid. The fluid as a continuum. Physical properties. Scope of fluid mechanics. Units and constants. Fluid statics: Equilibrium of fluid at rest. Thrust on plane surfaces. Buoyancy and thrusts on curved surfaces. Integral analysis: Control volume and mass conservation; continuity equation in one-dimensional flow; Incompressible flow. Basic principles, pressure at a point in a moving fluid. Bernoulli's Theorem. Elementary consideration of viscous fluids. Flow of Newtonian fluids in pipes – pressure drop and shear stress in pipe flows, velocity distribution, Reynolds number and its significance. Dimensional Analysis: The Pi-Theorem. Typical non-dimensional parameters. Dynamic similarity and models. Conservation equations of mass and momentum Flow in pipes: entry conditions. The boundary layer concept. Laminar and turbulent flow, transition, Pressure losses in bends, sudden changes of section, pipe fittings and valves. Diffusers, nozzles, branched pipes and flow distribution systems. Flow Measurements: Flow meters and flow measurement, head flow meters in closed and open conduits mechanical and electromagnetic flow meters, scale errors in flow measurement.

Minimum Academic Standards

In accordance with the NUC- MAS requirement facilities

400 Level

GET 499: Students Industrial Work Experience III (8 Units C: 24 weeks)

Learning Outcomes

Students on Industrial Work Experience Scheme (SIWES) are expected to:
1. be exposed and prepared for the Industrial work situation they are likely to meet after graduation, by developing their occupational competencies;
2. bridge the existing gap between theory and practice of programmes through exposure to real-life situations, including machines and equipment handling, professional work methods and ethics, human

relations, key performance assessment methods, and ways of safeguarding the work environment – human and materials;
3. experience/simulate the transition phase of students from school to the world of work and the environment seamlessly,and expose them to contacts for eventual job placements after graduation;
4. be motivated to identify the industrial and practice engineering challenges of their place of engagement and the larger society and creatively device impactful solutions to them; and
5. exploit the opportunity to improve and utilise their acquired critical thinking and innate creativity skills, during the program and SIWES Seminar presentation respectively.

Course Contents

On-the-job experience in industry chosen for practical working experience but not necessarily limited to the student's major (24 weeks from the end of the first semester at 400-Level to the beginning of the first semester of the following session. Thus, the second semester at 400-Level is spent in industry). Each student is expected to work in a programme related industry, research institute or regulatory agencies etc, for a period of 6 months under the guidance of an appropriate personnel in the establishment but supervised by an academic staff of the Department. On completion of the training, the student submits the completed Log book on the experience at the establishment., Also, there will be a comprehensive report covering the whole of the student's industrial training experiences (GET 299, GET 399 and GET 499), on which a seminar will be presented to the Department for overall assessment.

MEE 401: Mechanical (Machine) Engineering Design II (3 Units C: LH 45)
Leaning Outcomes

At the end of this course, the students should be able to:
1. demonstrate proficiency in the principles of design;
2. demonstrate proficiency in the selection of materials for design;
3. carry out simple stress analysis; and
4. demonstrate proficiency in principles of coupling, clutches and brakes.

Course Contents

Journal bearings. Application of Hertz stress theory. Fluid couplings. Lubrication mechanics: hydrodynamic theory applied to tapered wedge and journal bearings and hydrostatic lubrication applied to journal bearings. Gears and power transmission systems. Elements of fluid power system design. Design of cylinders, pipes and pipe joints, tubes, plates and flywheel. Seals, packaging, gaskets and shields. Failure analysis; various types of joints, design of machine elements; system design, design of gear systems; material selection in design; design; design and production matching; optimisation in design D

MEE 402 Theory (Mechanics) of Machines II (2 Units C: LH 30)
Leaning Outcomes

At the end of this course, the students should be able to:
1. identify the forces acting on a mechanism and the resolution of the forces;
2. demonstrate understanding of the performance of various mechanisms and principal machine elements as regards their kinematics and dynamics;
3. identify the types of motion and their applications;
4. identify forces on shaft and bearing due to single revolving mass;
5. demonstrate procedure for balancing several masses in different transverse planes;

6. prepare professional quality solutions and presentations to effectively communicate the results of analysis and design;
7. translate ideas and imaginations into conceptual designs using the tools of conventional engineering drawings and computer aided designs; and
8. use the knowledge of the course to solve real life problems related to production processes and to develop machines.

Course Contents

Force analysis of mechanisms, fluctuation of kinetic energy and inertial effects. Complete static and dynamic analysis. Flexible shaft couplings: belt, rope and chain drives. The flywheel and mechanical governors. Brakes and dynamometers. Balancing of multi-cylinder engines. Balancing of machinery. Vibration of machinery; free and forced vibration, damping, natural frequencies and critical speeds. Transverse vibrations of beams, whirling of shafts and torsional vibrations.

MEE 403: Applied Engineering Thermodynamics (2 Units C: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:
1. apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon;
2. identify fuel types, availability, utilisation and its conversion to energy, understand fuel chemistry, combustion analysis, develop combustion equations and conduct exhaust and flue gas analysis in the laboratory;
3. identify enthalpy changes, determine heating values of fuels, steam generators;
4. identify type of boilers, fuels and combustion controls in boilers and power plant efficiency;
5. perform air standard cycle analysis, refrigeration and heat pump cycles and demonstrate their various application in internal combustion engines/refrigeration systems;
6. demonstrate proficiency in energy analysis, fuel combustion and thermal systems design; and
7. provide solution to thermodynamic problems in HVAC systems, power plant, engines or renewable energy technology.

Course Contents

Multistage reciprocating compressors. Rotary compressors – centrifugal and axial-flow; stagnation properties. Simple gas turbine plant. The steam power plant. Combustion of fuels; chemistry of common hydrocarbon fuels, combustion with deficiency or excess air. Thermo-chemistry: Hess' Law of Heat Summation; heats of combustion and reaction; ideal adiabatic flame temperature. Reciprocating internal combustion engines. General thermodynamics relations. Kinetic theory of gas. Mixture of gases, psychometry, air-conditioning and cooling towers. Introduction to heat transfer.

MEE 404: Applied Fluid Mechanics (2 Units E: LH 30)

Learning Outcomes

At the end of this course, the students should be able to:
1. identify the various types of fluids and flows;
2. carry out simple calculations on floating and submerged surfaces;
3. explain the concept of fluid machinery for prototype development;
4. explain concepts of boundary layer;
5. explain and derive the Navier–Stokes equation for conservation of momentum and conservation of mass for Newtonian fluids;
6. describe machines that transfer energy between a rotors and a fluids;

7. identify pump types performed by simple pump selection, including both turbines and compressors; and
8. perform simple CDD grid processing, calculations and result processing.

Course Contents

Unsteady flow; oscillation in U-tube; surge tank; water hammer. Open-channel flows. Introductory concepts of boundary layer and re-circulating flows, mathematical derivation of Navier-stokes equations and its application. Dimensional analysis and similitude. Introduction to turbo machinery; characteristic curve for axial-flow and centrifugal pumps, fans, blowers, impulse and reaction turbines. Pump selection and application. Pipeline systems (Series and Parallel). Open channel flow. Overview of computational fluid dynamics (CFD)

MEE 405: Heat and Mass Transfer II (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:
1. explain the principle of heat by diffusion under steady or unsteady conditions;
2. explain continuity and momentum equations and their roles in convection heat transfer analysis;
3. recognise convection heat transfer in laminar and turbulent flows;
4. determine heat transfer coefficients in internal and external flows;
5. identify dimensionless groups in convection heat transfer;
6. identify combined modes of heat transfer;
7. perform simple heat exchanger analysis and design;
8. demonstrate an understanding of heat and mass transfer modes and models;
9. demonstrate understanding of the different types of interface reactions;
10. explain comparison of Fick's and Fourier's laws and similarities between conduction and mass transfer in stationary systems; and
11. apply principles of heat and mass transfer phenomena to selected processes.

Course Contents

Convection heat transfer: Newton's law of cooling. Energy equation of convection. Continuity and momentum equations and their roles in convection heat transfer analysis. Convection heat transfer in laminar and turbulent flows. Internal and external flows. Heat transfer coefficients. Dimensional analysis and dimensionless groups in convection heat transfer. Convection heat transfer correlations. Heat exchanger analysis and design. Combined modes of heat transfer.
Mass transfer: Mechanisms of mass transfer. Fick's law of mass diffusion. General diffusion law. Rate equations. Comparison of Fick's and Fourier's laws. Equations of mass transfer in stationary systems. Similarities between conduction and mass transfer in stationary systems. Mass transfer coefficient. Electrical analogy of mass transfer. Equimolal counter diffusion. Drying and humidification of solids and gases. Types of dryers. Evaporation. Mass transfer correlations in convective systems.

MEE 406: Advanced Mechanics of Materials (2 Units E:LH 30)

Learning Outcomes

At the end of this course, the students should be able to:
1. explain the theory, concepts, principles and governing equations of solid mechanics;
2. demonstrate the ability to deconstruct complex problems to produce effective outcomes;

3. perform simple analysis on thick cylinders; compound cylinders, rotating disks and bending of flat plates;
4. perform simple analysis on beams on an elastic foundation;
5. explain two-dimensional theory of elasticity and apply to elastoplastic problems;
6. use analytical, experimental and computational tools needed to solve the idealised problem;
7. Use these solutions to guide a corresponding design, manufacture, or failure analysis;
8. explain the selection, design and stress analysis of composite materials;
9. analyse the stresses in simple structures as used in industry, and
10. use interpersonal understanding, teamwork and communication skills working on group assignments.

Course Contents

Thick cylinders; compound cylinders. Rotating disks. Bending of flat plates. Beams on an elastic foundation. Membrane stresses in shells of revolution. Two-dimensional theory of elasticity. Elastoplastic problems and limit theory.

BIU-MEE 409: **Control Engineering**, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the control systems to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering control systems from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Overview

Modern day control engineering is a relatively new field of study that gained significant attention during the 20th century with the advancement of technology. It can be broadly defined or classified as practical application of control theory.

Control engineering plays an essential role in a wide range of control systems, from simple household washing machines to high-performance F-16 fighter aircraft. It seeks to understand physical systems, using mathematical modelling, in terms of inputs, outputs and various components with different behaviors; to use control system design tools to develop controllers for those systems; and to implement controllers in physical systems employing available technology.

A system can be mechanical, electrical, fluid, chemical, financial or biological, and its mathematical modelling, analysis and controller design uses control theory in one or many of the time, frequency and complex-s domains, depending on the nature of the design problem.

Objectives

The objectives of the course are to:
1. develop the mathematical models of the physical systems;
2. analyse the response and stability of the closed and open loop systems;

3. design various kinds of compensators;
4. explain the different representations of dynamic systems (time domain, frequency domain, state space);
5. define and explain feedback and feed-forward control architecture and discuss the importance of performance, robustness and stability in control design;
6. interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules;
7. compute stability of linear systems using the Routh array test and use this to generate control design constraints;
8. employ Evans root locus techniques in control design for real world systems;
9. compute gain and phase margins from Bode diagrams and Nyquist plots and understand their implications in terms of robust stability;
10. design Lead-Lag compensators based on frequency data for an open-loop linear system;
11. analyse the stability of systems by root locus and frequency response methods;
12. draw Bode diagrams, root locus graphs and Nyquist plots for the analysis of control systems solve numerical problems on control systems; and
13. apply MATLAB/Simulink to analyse open and closed loop performance and design linear feedback controllers.

Learning outcomes

At the end of this course, the students should be able to:
1. develop at least two mathematical models of the physical systems;
2. analyse the response and stability of the closed and open loop systems;
3. design at least three (3) kinds of compensators;
4. explain the different representations of dynamic systems (time domain, frequency domain, state space);
5. define and explain feedback and feed-forward control architecture and discuss the importance of performance, robustness and stability in control design;
6. interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules;
7. compute with at least three example the stability of linear systems using the Routh array test and use this to generate control design constraints;
8. employ Evans root locus techniques in control design for real world systems;
9. compute with at least three example the; gain and phase margins from Bode diagrams and Nyquist plots and state their implications in terms of robust stability;
10. design Lead-Lag compensators based on frequency data for an open-loop linear system;
11. analyse with at least three example the stability of systems by root locus and frequency response methods;
12. draw Bode diagrams, root locus graphs and Nyquist plots for the analysis of control systems solve at least three numerical problems on control systems; and
13. apply MATLAB/Simulink to analyse open and closed loop performance and design linear feedback controllers.

Course Contents

Introduction to control system: Concept of feedback and Automatic control, Effects of feedback, Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Types of control systems, Servomechanisms and regulators, examples of feedback control systems. Transfer function concept. Pole and Zeroes of a transfer function. Properties of Transfer function. Mathematical modelling of dynamic systems: Translational systems, Rotational systems, Mechanical coupling, Liquid level systems, Electrical analogy of Spring– Mass-Dashpot system. Block diagram representation of control systems. Block diagram algebra. Signal flow graph. Mason's gain formula. Control system components: Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tacho-generators. Actuators. Block diagram level description of feedback control systems for position control, speed control of DC motors, temperature control, liquid level control, voltage control of an Alternator. Time domain analysis: Time domain analysis of a standard second order closed loop system. Concept of undamped natural frequency, damping, overshoot, rise time and settling 697 time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on transient response. Stability by pole location. Routh-Hurwitz criteria and applications. Error Analysis: Steady state errors in control systems due to step, ramp and parabolic inputs. Concepts of system types and error constants. Stability Analysis: Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros. Frequency domain analysis of linear system: Bode plots, Polar plots, Nichol's chart, Concept of resonance frequency of peak magnification. Nyquist criteria, measure of relative stability, phase and gain margin. Determination of margins in Bode plot. Nichol's chart. M-circle and M-Contours in Nichols chart. Control System performance measures: Improvement of system performance through compensation. Lead, Lag and Lead- lag compensation, PI, PD and PID control.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities.

BIU-MEE 411: Production Technology I, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the production technology to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering production technology from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Production Engineering defines and works out how the product will be manufactured and/or assembled on the production line including design of packaging, ensuring the right quantity of components/products are delivered and aligned to support the speed of the production line.

Production technology is used to review efficiencies and eliminate waste within the manufacturing process to deliver high quality products/components to clearly defined standards. Production technology as a course is responsible for implementation of production processes and procedures, leading productivity improvements with project based activities, including new product introduction and manufacturing cell design to reduce waste, improve quality and safety, and reduce operating costs. Manage KPIs and ensure preventative actions are taken to maximize success. Work on many phases or sub-tasks of projects or entire projects of moderate complexity, with results impacting on project completion.

Objectives

The objectives of the course are to:

1. explain the principles of metal forming processes that will lead to acquisition of practical skills;
2. highlight the concepts of rolling and drawing;
3. discuss forging and extrusion processes and their applications;
4. explain the manufacture of tube drawing products, application of tube drawing and limitations of tube drawing;
5. define Forging;
6. list and explain the types of forging processes;
7. explain the meaning extrusion and the theory of extrusion.

Learning Outcomes

At the end of this course, the students should be able to:

1. explain at least two principles of metal forming processes that will lead to acquisition of practical skills;
2. highlight at least three concepts of rolling and drawing;
3. discuss forging and extrusion processes and state at least three applications;
4. explain the manufacture of tube drawing products, and state at least three applications of tube drawing and state at least three limitations of tube drawing;
5. define Forging;
6. list and explain at least three types of forging processes;
7. define extrusion and explain the theory of extrusion.

Course Contents

Mechanical working of metals: principles of hot and cold working of metals. Structural and properties changes during hot and cold working. Nature of stresses. strains and metal flows in various metal working operations; heating of stock: soaking pits and re-heating furnaces, de-scaling steel, precautions to be taken during reheating of ferrous and non-ferrous metals. Rolling: theory of rolling, rolling mills and accessories, elements of roll pass design, rolling defects, lubrication in rolling, manufacture of rolled product. Application of rolling and its limitation. Rod/wire drawing: Theory of rod/wire drawing, rod/wire drawing accessories, rod/wire drawing defects, manufacture of rod/wire drawing products, application of rod/wire drawing and their limitations. Tube drawing: Theory of tube drawing, tube drawing accessories, tube drawing defects, manufacture of tube drawing products, application of tube drawing and limitations of tube drawing, seamless tubes; deep drawing: theory of deep drawing, deep drawing accessories, deep drawing defects, manufacture of deep drawing products, application of deep drawing and its limitations. Forging, types of forging processes. forging equipment and forging defects. Roll forging and rotary swagging; extrusion: theory of extrusion/ application and limitations. types of and variables in extrusion. extrusion equipment and lubrication in extrusion.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 412 Advanced Mathematics for Mechanical Engineering, (2 Units; Core (C); LH = 45)

Senate-approved relevance

Advanced Mathematics for Mechanical Engineering ensured the training of quality graduates who are highly skilled and knowledgeable in the mathematical analysis to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU’s mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in the application of applied mathematics in Engineering design from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Engineering mathematics is a branch which helps us to understand mathematics concepts, mathematical methods and techniques that are typically used in engineering and industry.

The formation of mathematics as an applied branch at the service of the engineer is not a modern invention: the art of making calculations is as old as humankind, and its practitioners have been divided into a number of different groups, many of which have also been found in adjacent areas such as medicine or astronomy.

It is however worth noting that for quite some time applied mathematics has had more practical applications than theoretical ones, especially in mechanical engineering. As we know, engineering physics and engineering geology, these two may belong in the wider category of engineering science, engineering mathematics is a subject motivated by engineers' needs both for practical, theoretical, out with their specialization, and to deal with constraints to be effective in their work. Engineering mathematics overlaps with other engineering sciences, and it is close to the field of theoretical computer science.

Objectives

The objectives of the course are to:

1. solve some special functions of mathematics physics;
2. provide solution of differential equations of the second order by separation of variables;
3. apply numerical analysis with applications to the solve ordinary and partial differential equations;
4. Apply the solution of non-linear equations;
5. apply the elements of Probability in density and distribution functions, moments, standard distributions etc;
6. solve problems on regression and correlation, Large sampling theory. Test hypothesis and quality control;
7. apply the statistical analysis Software packages.

Learning outcomes

At the end of this course, students should be able to:

1. solve at least three special functions of mathematics physics;
2. provide solution of at least three differential equations of the second order by separation of variables;
3. apply numerical analysis with applications to the solve at least three ordinary and partial differential equations;
4. Apply the solution of non-linear equations to solve at least three;

5. apply at least three elements of probability in density and distribution functions, moments, standard distributions etc;
6. solve at least three problems on regression and correlation, Large sampling theory. Test hypothesis and quality control;
7. apply at least three statistical analysis Software packages.

Course Contents

Special functions of Mathematics Physics. Second order linear ordinary differential equations. singular points. the method of Frobenius. Introduction to special functions of Mathematical physics. Solution of differential equations of the second order by separation of variables. The gamma and beta functions Legendre polynomials. Bessel function, Hyper geometric functions. Numerical Methods in Engineering. Numerical analysis. Numerical analysis with applications to the solution of ordinary and partial differential equations. Interpolation formulae. Finite differences and finite elements. Application, the solution of non-linear equations. System of linear equations. Numerical evaluation of Eigen values. Probability- elements of Probability, density and distribution functions. moments. standard distributions etc. Statistics – Regression and correlation. Large sampling theory. Test hypothesis and quality control. Introduction to Statistical Analysis Software packages.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 413: Laboratory Practice III, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Laboratory Practice to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering Laboratory Practice from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Mechanical Engineering Workshop is a place of where students acquire knowledge on the operation of various process involved in manufacturing and production. The workshop practice course makes students competent in handling practical work in engineering environment. Mechanical Engineering workshop is also involved in different maintenance/ repair works for college. In BIU we have a modern workshop facility which supports the teaching and research activities of the engineering.

The primary function in this lab is to manufacture the engineering components from student/staff designs. The workshop supports teaching activities in the engineering by providing demonstrations of trades and other manufacturing processes and by manufacturing equipment used in teaching and research laboratories. Workshop facility plays an important role in the design phase of nearly all work related to manufacturing. Workshop staff assist both undergraduate and postgraduate students with all aspects of their designs, including material selection, design optimisation etc.

Objectives

The objectives of the course are to:

1. apply fluid mechanics concepts for analysis of basic fluid mechanics experiments;
2. apply heat transfer concepts for analysis of basic heat exchangers;
3. apply thermal system concepts for analysis of refrigeration and heat pump cycles, and psychrometrics processes;
4. design, perform, and report results of a mechanical engineering experiment;
5. write professional quality laboratory reports;
6. test mechanical systems, such as pumps and turbines, in the laboratory;
7. compare measured transient heat transfer temperature to that calculated by the theory;
8. apply theoretical concepts of fluid mechanics, and thermodynamics to analyze the efficiency of pumps and turbines;
9. produce experimental graphs using computer data acquisition software;
10. estimate experimental errors;
11. draw sketches explaining laboratory machine components;
12. write appropriate technical reports explaining experiments, results and draw conclusions;
13. apply fluid mechanics concepts to analyze flow around a cylinder in wind tunnel experiments.
14. perform experiments on the characteristic sleeve positions of a universal governor;
15. perform experiments on beam deflection;
16. perform hydrostatic experiments.

Learning outcomes

At the end of this course, students will be able to:

1. apply fluid mechanics concepts for analysis of basic fluid mechanics experiments;
2. apply at least two heat transfer concepts for analysis of basic heat exchangers;
3. apply at least two thermal system concepts for analysis of refrigeration and heat pump cycles, and psychrometrics processes;
4. Design, perform, and report results of a mechanical engineering experiment;
5. write at least five professional quality laboratory reports;
6. test at least two mechanical systems, such as pumps and turbines, in the laboratory;
7. compare measured transient heat transfer temperature to that calculated by the theory;
8. apply at least two theoretical concepts of fluid mechanics, and thermodynamics to analyze the efficiency of pumps and turbines;
9. produce at least five experimental graphs using computer data acquisition software;
10. estimate at least two experimental errors;
11. draw at least two sketches explaining laboratory machine components;
12. write at least five appropriate technical reports explaining experiments, results and draw conclusions;
13. apply fluid mechanics concepts to analyze flow around a cylinder in wind tunnel experiments;
14. perform at least two experiments on the characteristic sleeve positions of a universal governor;
15. perform at least two experiments on beam deflection;
16. perform at least two hydrostatic experiments.

Course Contents

Introduction to basic Thermal/Fluid sciences laboratory procedures and practices. Experimental topics to include fluid flow, heat exchanger basics, and basics of refrigeration. Student teams will design, analyze and document an experimental procedure. All procedures will result in a professional quality laboratory report. Performance test of a centrifugal pump. Performance test of a gear pump. Performance test of an impulse turbine (Pelton Wheel Experiment). Wind tunnel experiment of pressure distribution around a cylinder. Transient heat conduction in bodies of finite length. Presentation/discussion of lab reports and Review. Experiments on four bar linkage/crank rocker mechanism. Experiments on the slotted crank/quick return mechanism. Experiments on the scotch-yolk mechanism. Investigation of performance of motorized gyroscope. Experiments on the characteristic sleeve positions of a universal governor. Investigation of the performance of various governors. Investigation of torsional oscillations. Experiment on heating bodies and their stability. Investigation of impact of a jet. Measurement of centre of pressure. Experiment on beam deflection. Experiment on boilers. Hydrostatic experiments. Measurement of pressure. Static and dynamic balancing of motors. Curved bars experiment. Experiment on combined bending and torsion.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 408: Strength of Engineering Materials II, (2 Units; Elective (E); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the control systems to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering strength of materials from BIU being able to develop techniques that would enhance adequate knowledge in mechanical Engineering materials as a structural material for engineering fabrication of mechanical components in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Strength of materials is an Engineering discipline concerned with the ability of a material to resist mechanical forces when in use. A material's strength in a given application depends on many factors, including its resistance to deformation and cracking, and it often depends on the shape of the member being designed.

Strength of materials is the discipline related to calculation of stresses and strains in structures and mechanical components. In statics, the concept of static equilibrium was defined and the difference between internal and external forces introduced. However, it is not possible solely on basis of force calculation to assess the structural integrity of a component or structure. Strength of materials is obviously a core subject for mechanical and mechatronics engineers, since it enables us to determine by calculation, if the components we design will function as intended or fail. In order to do so, we define the term stress as a measure for internal force per area acting inside a structure.

Converting our internal forces to stresses by calculations provides us with a measure that contrary to forces can be related to characteristic material values, which we may either measure or look up. We will furthermore consider the problem related to calculation of deformations in components and structures. On basis of calculated deformations, it will be considered how to calculate strains as a measure for how large deformations are relative to the dimensions of the considered component. The intention of the present first chapter is to introduce the general framework, which in the following sets of notes will be applied for analysis of specific mechanical components. The chapter does not contain exercise problems like the following chapters, since we have not started analyzing components yet – we will only consider the general definitions.

Objectives

The objectives of the course are to:

1. explain the advance cases in bending moment and shear force and axial force diagrams;
2. analyse the fundamental beam theories;
3. differentiate the symmetrical and unsymmetrical bending and shear center in beam;
3. explain the failure theories and its application in the analysis of deflection, springs, Creep, fatigue, fracture and stress concentration;
4. distinguish the different state of stresses and deformation of axially loaded member;
6. describe Mohr’s circle method of stress analysis;
8. Solve at least three problems involving strain energy, strings and other strength factors.
9. apply concepts of stress and strain in determination of internal forces, point of shear center and stress in a solid structure;
10. explain the concept of creep, fatigue and their implications in the use of structural materials as failure process;
11. analyze motion and stresses in springs;
12. determine the stresses and strains induced in rotating disks and the implications.

Learning outcomes

At the end of this course, students should be able to:

1. explain at least three advance cases in bending moment and shear force and axial force diagrams;
2. analyse at least two fundamental beam theories;
3. differentiate the symmetrical and unsymmetrical bending and shear center in beam;
3. explain at least two failure theories and its application in the analysis of deflection, springs, Creep, fatigue, fracture and stress concentration;
4. distinguish at least two different state of stresses and deformation of axially loaded member;
6. describe Mohr’s circle method of stress analysis and use it to solve at least three poblems;
7. explain the failure theory and at least three processes in structural materials;
8. Solve at least three problems involving strain energy, strings and other strength factors.
9. apply at least two concepts of stress and strain in determination of internal forces, point of shear center and stress in a solid structure;
10. explain the concept of creep, fatigue and their implications in the use of structural materials as failure process;
11. analyze motion and stresses in springs with at least three solved examples;
12. determine with at least three solved examples the stresses and strains induced in rotating disks and the implications.

Course Contents

Bending of Beams: Bending curved beams. Crane hook. Principal stresses in beams. Beams with axial loads. Beam columns, combined bending and torsion. Deflection of Indeterminate Beams: Deflection of simple indeterminate beams. Continuous beams. Energy methods. Advanced Problems of Stress Analysis: Torsion of thin-walled tubes. Thick cylinders and spheres under internal and external pressures. Stresses due to shrink fit. Stress concentration, contact stresses. Stresses due to dynamic loading. The equivalent static load. Strength of riveted, bolted and bonded joints. Stress and strain analysis. Introduction to stresses and strains in two- and three-dimensional problems. Generalized stress-strain relations. Introduction to electrical resistance strain gauge and photo elastic methods of experimental stress analysis. Additional Topics: an exposure to fatigue, creep and brittle fracture

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 410: Failure Analysis and Prevention, (2 Units; Elective (E); LH = 15, PH = 45)

Senate-approved relevance

An institution where the advancement of engineering and Technology is optimal and continuously dynamic. Its graduates will become highly skilled and knowledgeable in the maintenance of industrial equipment and machinery. They will be capable to analyse failure in machines and become environmentally friendly engineers who will be very useful in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Most of the engineering activities in Nigerian industries have to do with maintenance. Average Nigerians lack a maintenance culture, and over the years, several government-established firms have stopped working as a result of poor maintenance emanating from machine and equipment failures. Thus, in the industry, maintaining machinery against failure is a critical aspect of engineering. Excessive downtime as a result of continuous breakdowns of machines and equipment could lead to losses in the industry.

Every engineer design against failure, and this is to ensure minimum downtime, thus optimizing profit and minimizing loss. Although this course will be domiciled in the department of mechanical engineering, it is designed for all facets of engineering that deal with machinery and equipment. It is intended to provide a systematic understanding of various aspects of failure, such as basic sources of failures of machine components, industrial equipment, and engineering tools relevant to failure and failure analysis; general failure analysis procedures through testing; macro- and microscopic observation of fracture and mode of fracture; metallographic procedures; and image analysis.

Objectives

The objectives of the course are to:

1. identify the engineering aspects of failure and failure analysis;
2. describe the general procedures for failure analysis;
3. describe the basic failure mechanisms;
4. identify common failure associated with industrial equipment;
5. describe the categories of failure modes;
6. state the effects of defects on industrial equipment;
7. explain failure analysis techniques;
8. describe failure prevention of industrial equipment;
9. describe failure and maintenance of machine components;
10. analysis the two failure modes.

Learning outcomes

On completion of the course, students should be able to:

1. explain six basic failure mechanism;
2. list five ways failure can be prevented in industrial equipment;
3. describe five ways of maintaining machine components;
4. explain at least three major causes of failure in industrial equipment;
5. describe at least four types of defects in industrial equipment;
6. analyze at least two failure modes in machine and its components;
7. list at a least three characteristics of defects in facilities;
8. describe at least two types of failure analysis techniques;
9. explain at least seven consequences of failure in industrial equipment;
10. identify at least four ways failure of machinery can be prevented in the industry.

Course Contents

Introduction: Engineering aspects of failure and failure analysis. Defects: Types and characteristics. effects of defects on service properties. General procedures for failure analysis. Basic Failure Mechanisms: Distortion Failures. Overload Failures. Fatigue Failures. Wear Failures. Corrosion Failures. Elevated Temperature Failures. Fractures. Failure Analysis Techniques and Preventive Measures: Non-Destructive Testing Techniques. Metallographic Techniques. Component Failures: Bearings. Chain and Belt Drives. Gears. Lifting Equipments. Mechanical Fasteners. Pressure Vessel. Seals, Shafts, Springs Failure. Modes and Effect Analysis: Failure Modes. Categories of Failure Modes. Failure Effects. Sources of Information about modes and effects. failure consequences. Case Studies on failure Analysis.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

500 level

GET 501: Engineering Project Management (3 Units C: LH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. explain the basics of project management as it relates to the Engineering discipline;
2. demonstrate knowledge and understanding of engineering, management and financial principles and apply these to their own work, as a member and/or leader in a team, to manage projects and in multi-disciplinary environments;
3. conduct, manage and execute projects in multi-disciplinary areas;
4. possess the skills needed for project management; and
5. work within the budget when executing a project for proper management.

Course Contents

Project management fundamentals – definitions, project environment, nature and characteristics, development practice, management by objectives, and the centrality of engineering to projects, infrastructures, national and global development. The scope of project management – organisational, financial, planning and control, personnel management, labour and public relations, wages and salary administration and resource management. Identification of project stakeholders; beneficiaries and impacted persons – functions, roles, responsibilities. Project community relations, communication and change management. Project planning, control and timeliness;decision making, forecasting, scheduling, work breakdown structure (WBS), deliverables and timelines, logical frameworks (log frames), risk analysis, role of subject matter experts (SMEs), role conflicts; Gantt Chart, CPM and PERT. Optimisation, linear programming as an aid to decision making, transport and materials handling. Monitoring and Evaluation – key performance indices (KPIs); methods of economic and technical evaluation. Industrial psychology, ergonomics/human factors and environmental impact considerations in engineering project design and management. Project business case - financial, technical and sustainability considerations. Case studies, site visits and invited industry professional seminars. General principles of management and appraisal techniques. Breakthrough and control management theory; production and maintenance management. Training and manpower development. The manager and policy formulation, objective setting, planning, organising and controlling, motivation and appraisal of results.

GET 502: Engineering Law (2 Units C: LH 30)

Learning Outcomes

Students will be able to:

1. describe and explain the basic concept, sources and aspects of law;
2. describe and explain the major differences between the various categories of law, courts and legal jurisdictions;
3. describe and explain legal principles and their application in professional engineering design and management services and their professional liability implications; and
4. develop reasoned analysis of real-life or hypothetical engineering scenarios using the legal principles undertake critical analysis of reliable information to develop, and practically present technical reports for use in varying judicial/quasi-judicial settings including as an expert witness.

Course Contents

Common Law: its history, definition, nature and division. Legislation, codification interpretation. Equity: definition and its main spheres. Law of contracts for Engineers: Forms of contract and criteria for selecting contractors; offer, acceptance, communication termination of contract. Terms of

Contracts; suppliers' duties – Damages and other Remedies. Termination/cancellation of contract Liquidation and Penalties; exemption clauses, safety and risk. Health and Safety. Duties of employers towards their employees. Duties imposed on employees. Fire precautions act. Design for safety. General principles of criminal law. Law of torts: definition, classification and liabilities. Patents: requirements, application, and infringement. Registered designs: application, requirements, types and infringement. Company law. Labour law and Industrial Law. Business registration.

MEE 503: Applied Design (3 Units C: LH 45)

Learning Outcomes

At the end of this course, the students should be able to:

1. demonstrate proficiency in systematic scientific design methodology;
2. demonstrate creative application of the design process to engineering problems;
3. demonstrate proficiency in design for the manufacture of complete mechanical systems and devices;
4. undertake a group design project;
5. submit reports showing all calculations, justification for choice of design and instructions on detail design, manufacture, testing and use; and
6. demonstrate use and evaluation of a CAD/CAM software package in the actual manufacturing design project.

Course Contents

Scientific Design Methodology: creative application of the design process to engineering problems with emphasis on the manufacture of complete systems to accomplish overall objectives of minimum weight, high efficiency while satisfying the design constraints. An appreciation of the process of engineering design, and of systematic procedures and tools usable in the design process, with particular reference to mechanical systems and devices. Topics include systematic problem definition, search for possible solutions, statistical analysis of stress/strength interference, experiment planning techniques, optimum design for minimum weight and cost, and management of the design process. Design Project: Students will be required to conduct a design project under supervision, using the presented techniques, and taking at least to a workable layout drawing of a device. The design should involve simple mechanical systems (e.g. testing and assembling devices, heat drive, etc.) fora specified duty, analyse its operating conditions and after considering the design criteria, choose between potential solutions. Reports submitted by students should contain all calculations, a comparison of potential solutions, justification for the design finally chosen, and instructions on detail design, manufacture, testing and use. Use and evaluation of several CAD/CAM software packages. Students will gain experience with CAD/CAM software while carrying out an actual manufacturing design project.

MEE 509: Project (6 Units C:L H/PH 270)

Learning Outcomes

At the end of this course, the students should be able to:

1. identify an engineering research problem;
2. demonstrate proficiency in PowerPoint presentation in a seminar;
3. demonstrate a methodology for actualising aims and objectives of a research project;
4. partake in a group research project efficiently; and
5. submit report comprising a topic, abstract, problem statement, aims and objectives, methodology, experimentation and/or analysis, results and analysis, conclusion and recommendation.

Course Contents

Final-year projects are assigned at the beginning of each academic year. Each final year student chooses a project supervisor in consultation with the final-year project coordinator. The process is entirely interactive, but the coordinator ensures that there is an even distribution of students amongst the lecturers. The final topic is decided by the student and his supervisor, selected from the fields of mechanics of solids and fluids, materials science, machine design, heat power, heat transfer, production technology, industrial engineering and management. Each student presents at least two seminars as part of their final year project, usually at the beginning and ending of the second semester. Each student is required to submit a report of their findings and undergo an oral examination. All seminars are scored by a panel of lecturers.

BIU-MEE 505: **Internal Combustion Engine**, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Internal Combustion Engine to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Internal Combustion Engine from BIU being able to develop techniques that would enhance automation in vehicles which is applied in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

An internal combustion engine (ICE or IC engine) is a heat engine in which the combustion of a fuel occurs with an oxidizer (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit.

In an internal combustion engine, the expansion of the high-temperature and high-pressure gases produced by combustion applies direct force to some component of the engine. The force is typically applied to pistons (piston engine), turbine blades (gas turbine), a rotor (Wankel engine), or a nozzle (jet engine). This force moves the component over a distance, transforming chemical energy into kinetic energy which is used to propel, move or power whatever the engine is attached to. This replaced the external combustion engine for applications where the weight or size of an engine were more important. Reciprocating piston engines are by far the most common power source for land and water vehicles, including automobiles, motorcycles, ships and to a lesser extent, locomotives (some are electrical but most use Diesel engines. Rotary engines of the Wankel design are used in some automobiles, aircraft and motorcycles. These are collectively known as internal-combustion-engine vehicles (ICEV). Where high power-to-weight ratios are required, internal combustion engines appear in the form of combustion turbines, or sometimes Wankel engines.

Powered aircraft typically use an ICE which may be a reciprocating engine. Airplanes can instead use jet engines and helicopters can instead employ turboshafts; both of which are types of turbines. In addition to providing propulsion, airliners may employ a separate ICE as an auxiliary power unit. Wankel engines are fitted to many unmanned aerial vehicles. ICEs drive large electric generators that power electrical grids. They are found in the form of combustion turbines with a typical electrical output in the range of some 100 MW. Combined cycle power plants use the high temperature exhaust to boil and superheat water steam to run a steam turbine. Thus, the efficiency is higher because more energy is extracted from the fuel than what could be extracted by the combustion engine alone. Combined cycle power plants achieve efficiencies in the range of 50% to 60%. In a smaller scale, stationary engines like gas engines or diesel generators are used for backup or for providing electrical power to areas not connected to an electric grid. Small engines (usually 2-stroke gasoline/petrol engines) are a common power source for lawnmowers, string trimmers, chain saws, leafblowers, pressure washers, snowmobiles, jet skis, outboard motors, mopeds, and motorcycles.

Objectives

The objectives of the course are to:

1. state the fuels and oxidants used in internal combustion engines;
2. apply the chemical reactions and equation in mass conservation and mass balance. ideal and real reactions.
3. apply the standardized energy and enthalpy to solve problems in IC engine;
4. Design and performance for spark ignition and compression ignition piston engines;
5. analyse the fuel injection. carburetion and combustion;
6. explain the multistage piston engine dynamics, mass balancing and vibration control;
7. describe the combustion and performance in internal combustion turbines;
8. explain the types of reciprocating internal combustion engines (ICE);
9. describe the power cycle of internal combustion engines using ideal gas cycles, air cycles, and fuel-air cycles;
10. explain engine heat transfer and its relation to thermal loading of engine components and cooling;
11. explain the characteristics of homogeneous combustion in SI-engines and spray combustion in CI-engines;
12. state the Fuel quality requirements of SI- and CI-engines;
13. describe the main components of exhaust emissions and explain the mechanisms of emission formation.

Learning outcomes

At the end of this course, students should be able to:

1. state at least three types fuels and oxidants used in internal combustion engines;
2. apply at least three chemical reactions and equation in mass conservation and mass balance. ideal and real reactions.
3. apply at least three standardized energy and enthalpy to solve problems in IC engine;
4. Design and performance for spark ignition and compression ignition piston engines;
5. analyse the fuel injection. carburetion and combustion;
6. explain the multistage piston engine dynamics, mass balancing and vibration control;
7. describe the combustion and performance in internal combustion turbines;
8. explain at least three types of reciprocating internal combustion engines (ICE);
9. describe the power cycle of internal combustion engines using ideal gas cycles, air cycles, and fuel-air cycles;
10. explain engine heat transfer and its relation to thermal loading of engine components and cooling;
11. explain at least four characteristics of homogeneous combustion in SI-engines and spray combustion in CI-engines;
12. state at least five Fuel quality requirements of SI- and CI-engines;

13. describe at least three main components of exhaust emissions and explain the mechanisms of emission formation.

Course Contents

Fuels and oxidants. Chemical reactions and equation. mass conservation. mass balance. ideal and real reactions. Standardized energy and enthalpy, maximum and adiabatic flame temperature. Dissociation and chemical equilibrium. Design and performance for spark ignition and compression ignition piston engines. Fuel injection. carburetion and combustion. multistage piston engine dynamics. mass balancing and vibration control. Combustion and performance in internal combustion turbines. Basic types and performance. Engine testing.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities.

BIU-MEE: **506 Production Technology II**, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Production Technology to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Production Technology systems from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

The Production Technologist's mission is to design, construct, operate and maintain any well, so that it is safe for use from spud to abandonment, delivering maximum value to the business. Production Technology is the discipline that integrates subsurface and surface in the oil and gas upstream industry. Traditionally, Production Technologists are known as "Well Doctors", as their focus area is the well. However, their remit extends from the reservoir, through the well into the production system and export. Over the years, the Production Technologist has taken centre stage in the development of Well, Reservoir and Facility Management and Production Optimisation.

Production Technology training course lays the foundation for Production Technology, covering the essential components of the discipline, with theory, exercises and group work. In addition, we will cover the application of Production Technology on Well Performance, Completion Design, Perforating, Artificial Lift, Stimulation, Sand Management, Well, Reservoir and Facility Management and Production Optimisation. The whole training course is highly interactive with opportunities for participants to share their experience and expertise. At the end of the training course, there is an opportunity to brainstorm and troubleshoot real issues, that participants have, which they can take back and apply their learnings to their wells and fields.

Objectives

The objectives of the course are to:
1. explain the meaning of specification and standardization for production;
2 explain interchangeable manufacture;
3 define limits and fits tolerances and apply it in mechanical engineering design;
4 decribe jigs and fixture;
5 apply jigs and fixtures in engineering production;
6 explain how tooling can be used for mass production;
7 define acceptable tolerances for manufacturing;
8 decribe hydraulic presses;
9 explain Economy of mass production;

Learning outcomes

At the end of this course, students should be able to:
1. define specification and standardization for production;
2 explain interchangeable manufacture and apply it in at least three manufacture processes;
3 define limits and fits tolerances and apply it in at least three mechanical engineering design;
4 explain jigs and fixture with at least five examples each;
5 apply jigs and fixtures in at least three engineering production;
6 explain how tooling can be used for mass production and illustrate with at least two examples;
7 define acceptable tolerances for manufacturing and illustrate with at least one example;
8 decribe hydraulic presses and illustrate with at least two examples;
9 explain Economy of mass production and illustrate with at least two examples;

Course Contents

Specification. and standardization for production. interchangeable manufacture. preferred sizes. limits and fits tolerances. Design of jigs, fixtures and tools. Tooling for mass production. gear cutting operations. broaching techniques (internal and external) numerically controlled machines (NMC). Hydraulic presses. fly presses. and their production capabilities. Economy of mass production.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 507: Refrigeration and Air- conditioning, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Refrigeration and Air-conditioning to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering Refrigeration and Air-conditioning from BIU being able to develop techniques that would enhance the cooling and heating in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Refrigeration keeps the cold air close; air conditioning pushes it away. Refrigeration uses coolant alone; air conditioning also uses the air from outside. Refrigeration deals with cooling and freezing, air conditioning deals with cooling and dehumidifying the air. Refrigeration may be defined as the process of reducing and maintaining a temperature of a space or material below that of the surroundings. This is accomplished by removing heat from body being refrigerated and transferred it to another body whose temperature is higher than that of the refrigerated body or space. It is evident that refrigerating and heating are actually opposite ends of the same process. Often, it is the desired result that distinguishes one from the other. Refrigeration is basic to the heating, ventilation and air conditioning industry.

One of the most important applications of refrigeration has been the preservation of perishable food products, food processing, packaging, storing and transportation by storing them at low temperatures. Refrigeration systems are also used extensively for providing thermal comfort to human beings by means of air conditioning. Air Conditioning refers to the treatment of air so as to simultaneously control its temperature, moisture content, cleanliness, odour and circulation, as required by occupants, a process, or products in the space. The subject of refrigeration and air conditioning has evolved out of human need for food and comfort. The purpose of refrigerator is to transfer heat from a cold chamber which is at a lower temperature than that of its surrounding. Elementary refrigerators have been used which utilizes the melting of ice or the sublimation of carbon-dioxide at atmospheric pressure to provide cooling effect.

Objectives

The objectives of the course are to:

1. apply the concept of refrigeration;
2. explain the methods of refrigeration;
3. describe and solve problems associated to Air refrigeration system;
4. investigate the vapour compression and vapour absorption refrigeration system;
5. explain the types of refrigerants;
6. discuss the various refrigeration cycles and the working principles of their sub-systems such as compressors, evaporators, condensers, etc.;
7. explain the working principles of Brine system, refrigerated cargo holds, thermal insulators and their instrumentation;
8. state the design requirements for onboard systems such as heating, humidification, ventilation and air-conditioning systems;
9. design, analyse and optimise the performance of ship borne air-conditioning system.
10. state Psychometric properties of air;
11. state the meaning of the term air-conditioning;
12. Discuss variuos air-conditioning plant;
13. apply principles of air-conditioning with emphasis on thermodynamic process involving air-vapour mixture.
14. analyse the Principles and application of automatic control elements.

Learning outcomes

At the end of this course, the students should be able to:

1. apply the concept of refrigeration;
2. explain at least three methods of refrigeration;
3. describe and solve at least three problems associated to Air refrigeration system;
4. investigate the vapour compression and vapour absorption refrigeration system;

5. explain at least three types of refrigerants;
6. discuss various refrigeration cycles and the working principles of their sub-systems such as compressors, evaporators, condensers, etc.;
7. explain the working principles of Brine system, refrigerated cargo holds, thermal insulators and their instrumentation;
8. state at least five design requirements for onboard systems such as heating, humidification, ventilation and air-conditioning systems; and
9. design, analyse and optimise the performance of ship borne air-conditioning system.
10. state at least three Psychometric properties of air;
11. state the meaning of the term air-conditioning;
12. Discuss at least three air-conditioning plant;
13. apply at least two principles of air-conditioning with emphasis on thermodynamic process involving air-vapour mixture;
14. analyse at least two Principles and application of automatic control elements.

Course Contents

Absorption refrigeration. Enthalpy/concentration Diagrams. Processes on binary mixtures. Thermodynamic cooling. Ultra-low temperature refrigeration. Gas liquefaction. Cold storage design of cold stores. Refrigeration equipment-special applications. Properties and characteristics of refrigerants, multi-pressure vapour. Compression Refrigeration Systems. Absorption refrigeration. Meaning of the term air-conditioning. The air-conditioning plant. Psychometric properties of air. Principles of air-conditioning plant. Principles of air-conditioning with emphasis on thermodynamic process involving air-vapour mixture. Production of atmospheric and thermal environment for human activity. Description of the various components of the air-conditioning plant – the compressors, evaporators, condensers and cooling tower, etc. Fundamental properties of moist air. Treatment of the various types of air-conditioning systems. Air-conditioning design- cooling load, calculations, design, control and layout of ventilation and air-conditioning systems. Noise reduction. Principles and application of automatic control elements.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 508: Engineering Maintenance and Reliability, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Engineering Maintenance and Reliability to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Engineering Maintenance and Reliability from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Engineering Maintenance and Reliability, in general, aims at achieving structures that satisfy safety criteria, serviceability and durability under specified service conditions. Since uncertainty is ubiquitous in engineering design, incorporation of uncertainties in engineering design is essentially required. Reliability analysis offers the theoretical framework for considering uncertainties in engineering decision scheme.

Reliability can be defined as the probability that a structure or system can perform a required function under specified service conditions during a given period of time. Conversely, the failure probability (or probability of failure) is the probability that a structure does not perform satisfactorily within a given period of time and stated conditions. As many different reliability analysis methods exist, this course will be focusses on the existing reliability analysis methods such as local Reliability Methods, Sampling Methods and Global Reliability Methods.

Objectives

The objectives of the course are to;

1. define the maintenance concepts;
2. analyse the reliability engineering and maintenance machine reliability, significant elements in the concept of reliability, and failure of machines;
3. state maintenance policies, preventive and corrective maintenance;
4. State the manufacturer's maintenance recommendations; ;
5. state how to boost efficiency and make the optimum use of resources.
6. apply the production cost in reliability engineering;
7. define maintenance;
8. state how to increases the life of machines through regular machine maintenance and inspections.

Learning outcomes

At the end of this course, the students should be able to:

1. define the maintenance concepts;
2. analyse the reliability engineering and maintenance machine reliability, and state at least five significant elements in the concept of reliability and failure of machines;
3. state at least five maintenance policies, preventive and corrective maintenance;
4. State at least five manufacturer's maintenance recommendations; ;
5. state at least five ways to boost efficiency and make the optimum use of resources.
6. apply the production cost in reliability engineering;
7. define maintenance;
8. state at least five ways to increases the life of machines through regular machine maintenance and inspections.

Course Contents

Maintenance. Concepts and Definitions of maintenance. Role of Engineering organization. Engineering maintenance and corporate survival. Relevant Maintenance Functions. Human understanding/appreciation. Planning. Human resource development. Materials and spare parts Management. Documentation and Behavioral influence. Maintenance function. Reliability engineering and maintenance machine reliability. significant elements in the concept of reliability. Failure machines. concept of availability. factors influencing availability. Maintenance policies. preventive and corrective maintenance. Manufacturer's maintenance recommendations. collection of information. Breakdown time distributions. guides to preventive maintenance policy. corrective maintenance guidelines.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 512: Computer Applications in Mechanical Engineering, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Computer Applications in Mechanical Engineering enhance the training of quality graduates who are highly skilled and knowledgeable in the computer applications to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in computer applications in mechanical engineering from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Mechanical Engineers use computers more extensively than any other physical scientists. Computers are used to help in the design process, computers control manufacturing equipment and robots, and computers are used heavily in the fields of fluid mechanics, solid mechanics and heat transfer. Because many fields of mechanical engineering are mathematically challenging, computers are extremely helpful and are used constantly.

The power of modern computers makes it possible for mechanical engineers to study proposed aircraft and car body designs before companies are involved in the expense of building physical models. Using computer simulations, engineers can visualize the fluid flow and temperatures in areas that are experimentally inaccessible such as the internal parts of a car engine. Computers are used in research to extend investigation beyond the limits of an experimental setup. It is often much quicker to run a computer experiment than a physical one. When computer investigation is combined with careful experiments and sound theory, the productivity of computer research can be tremendous.

Objectives

The objectives of the course are to:

1. apply the Transformations and Projections to draw Free- Form Curve Design;
2. apply the Surface Patch Modelling and Solid Modelling to solve engineering problems;
3. apply Finite Element Methods of Optimization;
4. apply Computer Aided Manufacturing (CAM);
5. apply software in for the programming engineering type problems in MATLAB;
6. utilize the built in solvers in MATLAB;
7. analyse simulating dynamic systems;
8. apply different optimization techniques;
9. apply Laplace transform and transfer function;
10. apply ANSYS to solving engineering problems.

Learning outcomes

At the end of this course, the students should be able to:
1. apply the Transformations and Projections to draw at least three Free- Form Curve Design;
2. apply the Surface Patch Modelling and Solid Modelling to solve at least two engineering problems;
3. apply with at least two examples using Finite Element Methods of Optimization;
4. apply with at least two examples using Computer Aided Manufacturing (CAM);
5. apply with at least two examples using software for the programming engineering type problems in MATLAB;
6. utilize at least two built in solvers in MATLAB;
7. analyse with at least two examples the simulating dynamic systems;
8. apply at least three optimization techniques;
9. apply Laplace transform and transfer function to solve at least two problems;
10. apply ANSYS to solving at least two engineering problems.

Course Contents

Transformations and Projections. Free- Form Curve Design. Surface Patch Modelling. Solid Modelling. Reverse Engineering. Finite Element Methods. Optimization. Computer Aided Manufacturing (CAM). Computer applications in design, thermodynamics, fluids, thermal power. heat transfer and combustion. applied mechanics and metallurgy. Introduction – Why numerical methods. Review of MATLAB concepts. Simulation of dynamic systems a. Laplace transform and transfer function b. Simulation using Simulink. Solution of differential equation a. Runge – Kutta method for a system of ordinary differential equations b. Use of MATLAB ode function. Optimization

a. Unconstrained optimization Method of deepest descent b. Constrained optimization Lagrange multipliers c. Using Matlab Fmincon optimization function. Solutions (Roots) of nonlinear equations. Numerical integration a. Simpson's rule b. Improper integrals c. MATLAB quadl function. Use of ANSYS.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 514: Automobile Engineering, (2 Units; Core (C); LH = 15, PH = 45)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Automobile Engineering to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Automobile Engineering from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Automotive engineering, along with naval architecture and aerospace engineering, is a subfield of vehicle engineering that applies mechanical, electrical, electronic, software, and safety engineering principles to the development, production, and use of motorcycles, cars, and trucks as well as their individual engineering subsystems. Vehicle modifications are also a part of it.

The creation and assembly of all the components for autos falls under the manufacturing realm. The discipline of automobile engineering requires a lot of research and directly applies mathematical models and algorithms. Automotive engineering is the study of designing, developing, making, and testing cars or vehicle components from concept to production. These three activities; roduction, development, and manufacturing are the main ones in this industry.

Objectives

The objectives of the course are to:

1. describe the internal combustion engines;
2. describe all types of fuels available for combustion in the internal combustion engines, efficiency of the combustion and the relation this has with pressure ratio;
3. state the environmental impact of the combustion of the fuels due to exhaust emission;
4. state the implications of design on the combustion efficiency of internal combustion engines;
5. explain the brake and braking systems;
6. describe the Clutches, gear-boxes, manual and automatic Transmissions and Suspensions Steering systems;
7. describe the Air-conditioning as electrical equipment in automobile.

Learning outcomes

At the end of this course, the students should be able to:

1. describe the internal combustion engines and illustrate with at least three examples;
2. describe at least five types of fuels available for combustion in the internal combustion engines, efficiency of the combustion and the relation this has with pressure ratio;
3. state at least five environmental impact of the combustion of the fuels due to exhaust emission;
4. state at least five implications of design on the combustion efficiency of internal combustion engines;
5. explain the brake and braking systems and illustrate with at least three examples;
6. describe the Clutches, gear-boxes, manual and automatic Transmissions and Suspensions Steering systems;
7. describe the Air-conditioning as electrical equipment in automobile.

Course Contents

This course introduces students to internal combustion engines, their efficiency and pollutants emission. It looks at the various emerging power technologies in the automotive industry and the current and alternative fuels and combustion processes. Choice of fuel and the design of efficient engine operating parameters and their by-products will also be discussed. Mechanics of vehicles. Vehicle components and design, Traction. Engine and transmission data. Fuel injection. Clutches, gear-boxes, manual and automatic. Transmissions. Suspensions. Steering systems, Brakes, tyres, Air-conditioning, Electrical equipment.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 509: Stress Analysis, (2 Units; Core (C); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Stress Analysis to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering control systems from BIU being able to develop techniques that would enhance failure free materials in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Stress Analysis, in general, aims at achieving structures or mechanical parts that satisfy safety criteria, serviceability and durability under specified service conditions. Since uncertainty is ubiquitous in engineering design, incorporation of uncertainties in engineering design is essentially required. Stress analysis offers the theoretical framework for considering uncertainties in engineering decision scheme.

Reliability which is an integral part of stress analysis can be defined as the probability that a structure or system can perform a required function under specified service conditions during a given period of time. Conversely, the failure probability (or probability of failure) is the probability that a structure does not perform satisfactorily within a given period of time and stated conditions. As many different reliability analysis methods exist, this course will be focusses on the existing stress analysis methods such as local stressed Methods, Sampling Methods and Global Reliability Methods

Objectives

The objectives of the course are to:

1. explain the concept of a general three-dimensional state of stress;
2. analyse equilibrium equations, stress transformation equations and Principal stresses;
3. solve some problems involving maximums shear stress.;
4. determine the mean deviator and octahedral stresses;
5. draw the curves to show Strain-displacement relations;
6. apply the Compatibility equations to solving problems;
7. analyse the plane stress and plane strain;
8. analyse Airy’s Stress Function and its application;
9. state the principles and application Electrical resistance in train gauges;
10. explain the Photoelasticity in Brittle lacquers.

Learning outcomes

At the end of this course, the students should be able to:

1. explain the concept of a general three-dimensional state of stress;
2. analyse with at least three examples each the equilibrium equations, stress transformation equations and Principal stresses;
3. solve at least three problems involving maximums shear stress.;
4. determine the mean deviator and octahedral stresses;
5. draw the curves to show Strain-displacement relations;
6. apply the Compatibility equations to solving at least three problems;
7. analyse the plane stress and plane strain and solve three problems;
8. analyse with at least two examples the Airy’s Stress Function and its application;
9. state at least two principles and application Electrical resistance in train gauges;
10. discuss the Photoelasticity in Brittle lacquers.

Course Contents

Concept of a general three-dimensional state of stress. Equilibrium equations. stress transformation equations. Principal stresses. Maximums shear stress. Mean deviator and octahedral stresses. Strain analysis. Strain-displacement relations/ Compatibility equations. Plane stress and Plane strain. Airy's Stress Function and its application. Experimental mechanics. Principles and Application. Electrical resistance. resistance strain gauges. Photoelasticity. Brittle lacquers.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 513: **Product Design**, (2 Units; Core (C); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Product Design to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering Product Design from BIU being able to develop techniques that would enhance engineering design of facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Product design is the core task of a product development cycle. It is through design that an optimum solution leading to an optimum product performance is found, it is through design that a product prototype is constructed and evaluated before costly mass manufacturing begins, and it is through design that serious liability issues and safety problems are avoided before a product enters the market. Product design is primarily an engineering job, and in virtually all product development applications, it represents the vehicle that transforms science to technology and technology to consumers in the form of a product or service. One of the key design aspects, which is often overlooked in engineering education programs, is design conceptualization in which critical questions must be addressed before design analysis proceeds. Product design is cross-functional, knowledge-intensive work that has become increasingly important in today's fast-paced, globally competitive environment. It is a key strategic activity in many firms because new products contribute significantly to sales revenue. Product design is a critical factor in organizational success because it sets the characteristics, features, and performance of the service or good that consumers demand.

Product design engineering is the process of developing functional products for customers that can be then sold by businesses in competitive markets. It is fundamental to global market success and requires not only aesthetics and customer appeal, but also fitness for purpose and correct functionality, together with superior quality at a competitive price. It is only when design is combined with a knowledge of the opportunities presented by new design tools, new materials and manufacturing processes, that innovative ideas may be exploited to their full potential. This linking of product design with manufacturing technologies is demanded by a wide range of industrial and commercial sectors, and is critical to allowing quality products to be designed and produced in the right quantities, to an appropriate level of quality and at the right price. It brings together detailed and versatile product design skills with an in-depth knowledge of manufacturing processes and technologies. By combining a thorough design education with a sound engineering base, our graduates are ideally placed to conceive and develop innovative designs and turn them into profitable products.

Objectives

The objectives of the course are to:
1. explain the design process and explain the methodology used;
2. verify and validate design used in product analysis;
3. state the product design specification;
4. state specification of manufacturing processes, specification of pneumatic devices and fluid flow requirements;
5. Describe how Bill of materials are generated or obtained;
6. Produce better quality at the lowest possible price;
7. analyse using detailed design calculations.

Learning outcomes

At the end of this course, the students should be able to:
1. explain at least two design process and explain the methodology used;
2. verify and validate at least two design used in product analysis;
3. state at least three product design specification;
4. state at least three specification of manufacturing processes, specification of pneumatic devices and fluid flow requirements;
5. describe how Bill of materials are generated or obtained and illustrate with at least two examples;
6. produce better quality at the lowest possible price;
7. analyse using detailed design calculations and illustrate with at least two examples.

Course Contents

Design process and methodology. Failure modes, effects and critical analysis (ISO 9000 Quality system). Design verification and validation (Fluid analysis requirements for given design problem). Damping and suspension design Project Structure (Identification of project goals). Product Design Specification. Design Concept formulation. Detailed Design Production (Material specification, specification of manufacturing processes, spec. of pneumatic devices and fluid flow requirements, detailed design calculations, working drawings, Bill of materials)

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 510: Metallurgy of Materials Production and Processing, (2 Units; Elective (E); LH = 15, PH = 45)

Senate-approved relevance

Metallurgy of Materials Production and Processing ensure the training of quality graduates who are highly skilled and knowledgeable in Metallurgy of Materials to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering Materials Production and Processing from BIU being able to develop techniques that would enhance production in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Metallurgy is a domain of materials science and engineering that studies the physical and chemical behavior of metallic elements, their inter-metallic compounds, and their mixtures, which are known as alloys. Metallurgy encompasses both the science and the technology of metals; that is, the way in which science is applied to the production of metals, and the engineering of metal components used in products for both consumers and manufacturers. Metallurgy is distinct from the craft of metalworking.

Metalworking relies on metallurgy in a similar manner to how medicine relies on medical science for technical advancement. A specialist practitioner of metallurgy is known as a metallurgist. The science of metallurgy is further subdivided into two broad categories: chemical metallurgy and physical metallurgy. Chemical metallurgy is chiefly concerned with the reduction and oxidation of metals, and the chemical performance of metals. Subjects of study in chemical metallurgy include mineral processing, the extraction of metals, thermodynamics, electrochemistry, and chemical degradation (corrosion). In contrast, physical metallurgy focuses on the mechanical properties of metals, the physical properties of metals, and the physical performance of metals. Topics studied in physical metallurgy include crystallography, material characterization, mechanical metallurgy, phase transformations, and failure mechanisms.

In production engineering, metallurgy is concerned with the production of metallic components for use in consumer or engineering products. This involves production of alloys, shaping, heat treatment and surface treatment of product. The task of the metallurgist is to achieve balance between material properties, such as cost, weight, strength, toughness, hardness, corrosion, fatigue resistance and performance in temperature extremes. To achieve this goal, the operating environment must be carefully considered.[citation needed]. Determining the hardness of the metal using the Rockwell, Vickers, and Brinell hardness scales is a commonly used practice that helps better understand the metal's elasticity and plasticity for different applications and production processes. In a saltwater environment, most ferrous metals and some non-ferrous alloys corrode quickly. Metals exposed to cold or cryogenic conditions may undergo a ductile to brittle transition and lose their

Objectives

The objectives of the course are to:
1. apply the principles of hot and cold working of metals;
2. explain the Nature of stresses. strains and metal flows in various metal working operations;
3. explain the principle of metal forming processes;
4. describe the soaking pits and re-heating furnaces;
5. state the precautions to be taken during reheating of ferrous and non-ferrous metals;
6. highlight the concepts of rolling and drawing;
7. state Theory of rod/wire drawing. rod/wire drawing accessories;
8. explain the manufacture of rod/wire drawing products;
10. state the applications of rod/wire drawing and their limitations;
11. state the Theory of tube drawing and tube drawing accessories;
12. state tube drawing defects;

13. explain the manufacture of tube drawing products and state its applications and limitations;
14. explain Forging and describe the types of forging processes and forging equipment;
15. state the forging defects;
16. discuss extrusion processes and their applications;
17. analyse the Corrosion processes in metals.

Learning outcomes

At the end of this course, the students should be able to:
1. apply the principles of hot and cold working of metals;
2. explain the Nature of stresses, strains and metal flows in various metal working operations;
3. explain at least three principles of metal forming processes;
4. describe the soaking pits and re-heating furnaces;
5. state at least five precautions to be taken during reheating of ferrous and non-ferrous metals;
6. highlight at least three concepts of rolling and drawing;
7. state at least two theory of rod/wire drawing;
8. explain with at least two examples the manufacture of rod/wire drawing products;
10. state at least three applications of rod/wire drawing and at least three limitations;
11. state at least five tube drawing defects;
12. explain the manufacture of tube drawing products and state at least three applications and limitations;
13. explain Forging and describe at least two types of forging processes and forging equipment;
14. state at least three forging defects;
15. discuss at least three extrusion processes and their applications;
16. analyse the Corrosion processes in metals.

Course Contents

Mechanical working of metals: principles of hot and cold working of metals. Structural and properties changes during hot and cold working. Nature of stresses. strains and metal flows in various metal working operations. heating of stock: soaking pits and re-heating furnaces. de-scaling steel, precautions to be taken during reheating of ferrous and non-ferrous metals. Rolling: theory of rolling. rolling mills and accessories. elements of roll pass design. rolling defects. lubrication in rolling, manufacture of rolled product. Application of rolling and its limitation. Rod/wire drawing. Theory of rod/wire drawing. rod/wire drawing accessories. rod/wire drawing defects. manufacture of rod/wire drawing products. application of rod/wire drawing and their limitations. Tube drawing. Theory of tube drawing. tube drawing accessories. tube drawing defects. manufacture of tube drawing products. application of tube drawing and limitations of tube drawing. seamless tubes. deep drawing. theory of deep drawing. deep drawing accessories. deep drawing defects. manufacture of deep drawing products. application of deep drawing and its limitations. Forging, types of forging processes. forging equipment and forging defects. Roll forging and rotary swagging. extrusion: theory of extrusion. application and limitations. types of and variables in extrusion. extrusion equipment and lubrication in extrusion. Corrosion analysis.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 511: Turbo Machinery, (2 Units; Elective (E); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Turbo Machinery to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in Turbo Machinery from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

Turbomachinery, in mechanical engineering, describes machines that transfer energy between a rotor and a fluid, including both turbines and compressors. While a turbine transfers energy from a fluid to a rotor, a compressor transfers energy from a rotor to a fluid. These two types of machines are governed by the same basic relationships including Newton's second Law of Motion and Euler's pump and turbine equation for compressible fluids. Centrifugal pumps are also turbomachines that transfer energy from a rotor to a fluid, usually a liquid, while turbines and compressors usually work with a gas.

Turbomachinery can be defined as a machine that exchanges energy between a working fluid and the blades of a turbine. The main applications of turbomachinery are the use of turbines to produce hydroelectricity or in an aircraft jet engine. Turbomachinery deals with the study of steam and jet engines that make up essentially the entire heavy-duty industry. It is an arrangement designed to convert kinetic energy into other forms of usable energy, depending upon the application of the unit. Turbomachinery covers industries from energy conversion to the aeronautical engineering sector.

Objectives

The objectives of the course are to:

1. apply the knowledge of basic principles, governing equations and applications of turbo machine;
2. provide the students with opportunities to apply basic thermo-fluid dynamics flow equations to Turbo machines;
3. select turbo machine for given application;
4. predict performance of turbo machine using model analysis;
5. explain the construction and working principle of Turbo Machines;
6. evaluate the performance characteristics of Turbo Machines.

Learning outcomes

At the end of this course, the students should be able to:

1. state the Euler law;
2. state at least two principles of turbo machinery;
3. describe at least two Types of basic flow calculation and performance of fans;
4. analyse the rotor dynamic pumps profile theory applied to the design of axial compressor stage;
5. apply thermodynamics and kinematics principles to turbo machines;
6. analyze at least with two examples the performance of turbo machines;
7. select turbo machine for given application and analyse with two examples;

8. predict performance of turbo machine using model analysis;
9. describe at least two mechanisms behind working of turbines;
10. apply knowledge of Turbo machines to optimize the efficiencies of turbines.
11. analyse at least with two examples the performance for multi-stage turbines and compressors.

Course Contents

Euler law. and principles of turbo machinery. Types of basic flow calculation and performance of fans. rotor dynamic pumps. and hydraulic turbines. Positive displacement pumps. Fundamentals of steam. and gas turbine design. impulse and reaction turbines. profile theory applied to the design of axial compressor stage. Performance for multi-stage turbines. and compressors.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 515: Fluid Machinery, (2 Units; Elective (E); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Fluid Machinery to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering Fluid Machinery from BIU being able to develop techniques that would enhance automation in engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

The field of fluid machinery is a significant area of application of fluid mechanics and thermodynamics. Fluid energy machines are the most important group of machines. This field plays a fundamental role in the training of future engineers. Knowing about the function, setup, properties, and operation of fluid machinery is an essential part of the technical training.

The field of machinery in general and the field of systems engineering in particular requires – in addition to general fluid mechanics separate lectures and practical training on fluid machinery. A fluid machine is a device which converts the energy stored by a fluid into mechanical energy or *vice versa*. The energy stored by a fluid mass appears in the form of potential, kinetic and intermolecular energy. The mechanical energy, on the other hand, is usually transmitted by a rotating shaft. Machines using liquid (mainly water, for almost all practical purposes) are termed as hydraulic machines.

Objectives

The objectives of the course are to:
1. state the Aerofoil and Airscrew Theory.
2. explain the conformal mapping and transformations.
3. state the basis of aerofoil theory.
4. apply aerofoil in two dimensions
5. derive the relation between lift and circulation generation of lift and drag.
6. apply airscrew momentum and bald element theory.

7. state the aerofoil characteristics and wing section nomenclature.
8. explain the hydraulic turbines and state the dimensional analysis and similitude, performance characteristics.
9. state the conditions for efficient operation unit and specific speeds in
10. explain the draft tube design. manufacture and installation techniques.
11. describe the hydrodynamics couplings.
12. explain the components and design and construction. performance characteristics.
13. explain the reciprocating and centrifugal pump types.
14.draw theoretical and actual discharge head curves and state configurations, scale effects. selection charts.

Learning outcomes

At the end of this course, the students should be able to:
1. state the Aerofoil and Airscrew Theory.
2. explain at least two conformal mapping and transformations.
3. state at least two basis of aerofoil theory.
4. apply aerofoil in two dimensions
5. derive the relation between lift and circulation generation of lift and drag.
6. apply airscrew momentum and bald element theory.
7. state at least three aerofoil characteristics and wing section nomenclature.
8. explain the hydraulic turbines and state at least two-dimensional analysis, similitude, and performance characteristics.
9. state at least three conditions for efficient operation unit and specific speeds;
10. explain the draft tube design, manufacture and installation techniques.
11. describe at least two hydrodynamics couplings.
12. explain the components and design and construction. performance characteristics.
13. explain the reciprocating and centrifugal type of pump;
14.draw theoretical and actual discharge head curves and state configurations, scale effects and selection charts.

Course Contents

Aerofoil and Airscrew Theory. Introduction to flight. conformal mapping and transformations. the basis of aerofoil theory. aerofoil in two dimensions. relation between lift and circulation generation of lift and drag. airscrew momentum and bald element theory. aerofoil characteristics and wing section nomenclature. Hydraulic Turbines Dimensional analysis and similitude, performance characteristics. conditions for efficient operation. unit and specific speeds. draft tube design. manufacture and installation techniques. hydrodynamics couplings. Similarly, considerations. components and design and construction. performance characteristics. reciprocating and centrifugal types. theoretical and actual discharge head curves. configurations, scale effects. selection charts.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

BIU-MEE 514: Introduction to Bioengineering, (2 Units; Elective (E); LH = 30)

Senate-approved relevance

Training of quality graduates who are highly skilled and knowledgeable in the Introduction to Bioengineering to enhance the development of engineering and technology in Nigeria and the world at large. This is in agreement with BIU's mission to raise academics, professionals and entrepreneurs, who are Disciples of Christ, and excelling as transparent mechanical engineering graduates. Relevance is seen in engineering Introduction to Bioengineering from BIU being able to develop techniques that would enhance engineering facilities in the public and private sectors of the economy, as well as in Nigeria's rapid industrialization and development.

Course Overview

This course provides basic science knowledge and engineering practices used by biomedical engineers toward solving problems in human medicine.

Bio-engineering is the application of the principles and problem-solving techniques of engineering to biology and medicine. This is evident throughout healthcare, from diagnosis and analysis to treatment and recovery, and has entered the public conscience though the proliferation of implantable medical devices, such as pacemakers and artificial hips, to more futuristic technologies such as stem cell engineering and the 3-D printing of biological organs. Engineering itself is an innovative field, the origin of ideas leading to everything from automobiles to aerospace, skyscrapers to sonar. **Bioengineering** focuses on the advances that improve human health and health care at all levels.

Objectives

The objectives of the course are to:

1. apply the Mechanics of movement in living creatures;
2. analyse the human body as a machine;
3. analyse Engineering mechanics and human function;
4 investigate the human musculoskeletal system;
5. analyse the mechanics of motion and design of prosthesis and orthotics;
6. analyse the Bio-fluid mechanics and its applications in biomechanics

Learning outcomes

At the end of this course, the students should be able to:

1. apply the Mechanics of movement in living creatures and illustrate with at least two examples;
2. analyse the human body as a machine and illustrate with at least two examples;
3. analyse Engineering mechanics and human function and illustrate with at least two examples;
4 investigate the human musculoskeletal system and illustrate with at least two examples;
5. analyse the mechanics of motion and design of prosthesis and orthotics and illustrate with at least two examples;
6. analyse the Bio-fluid mechanics and state at least three applications in biomechanics.

Course Contents

Introduction. Mechanics of movement in living creatures. The human body as a machine. Engineering mechanics. and human function. The human musculoskeletal system. Mechanics of motion. Design of prosthesis. and orthotics. Bio-fluid mechanics. Applications of biomechanics.

Minimum Academic Standards

Engineering workshop and laboratory with NUC-MAS requirement facilities

Minimum Academic Standards

Equipment

Common Facilities

1. University Libraries
2. Lecture Theatres and Lecture Rooms
3. Laboratories/ Central Workshops
4. Drawing Studio
5. Computer-Aided Graphics Laboratory
6. Faculty Computer Laboratory
7. Industrial Training Coordinator's Office.
8. Laboratories for Some General Engineering Courses

Laboratories/Workshops

General Workshop
Drawing and Design Studio
Mechanics of Machines
Strength of Materials
Thermodynamics
Fluid Mechanics
Metallurgy

General Workshop Equipment

Fitting & Machining Section

1. Work benches with vices for metal work
2. Tool boxes containing hand tools such as screw drivers, wrenches, hammers, hacksaws, files, centre punch, chisel, scrapers, etc.
3. Lathe machines
4. CNC lathe machine
5. Milling machines
6. CNC milling machine
7. Drilling machines
8. Grinding machines
9. Folding machines
10. Power hacksaw
11. Shaping machines
12. Tennoning machine
13. Vertical mortising machine
14. Dovetailing machine
15. Vernier Callipers and Micrometer Screw Gauges
16. Sheet metal folding machine

Foundry Section

1. Furnaces (heat treatment facility)
2. Casting facilities

Welding & Fabrication Section

1. Arc welding machines and accessories
2. Gas welding facilities
3. Safety goggles, eye and ear protectors
4. Pop riveting machine
5. Guillotine cutting Machine
6. Rolling machine, etc.
7. Spot welding machines

Carpentry & Woodwork Section (Wood processing machines and equipment)

1. Band saw, radial arm saw and circular saw
2. Surfacing machine
3. Mortise machine
4. Thicknessing/Planing machine
5. Wood Lathe machine
6. Portable sander machine
7. Jig saw, rip saw, cross-cut saw, panel saw, tenon saw, compass saw
8. Drilling machine
9. Chest drill
10. Spraying machine
11. Oil stone
12. Wood workbenches with vices
13. G clamp, F clamp, Sash clamp
14. Jack planes, smooth planes

15. Other hand tools such as tri square, claw hammer, pincer, marking gauge, mortise gauge, spirit level, flat chisel, wood rasp, round chisel, wood mallet, spoke shave, screw drivers, tape rule, scraper.

Electrical/Electronic Section

1. Water distillers
2. Hydrometers
3. Multimeters, voltmeters, ammeters and clamp meters
4. Soldering irons
5. Battery chargers
6. Standard tool boxes for electrical and electronics works
7. Electrical/electronics data books
8. Oscilloscopes
9. Tachometers and phase sequence meters
10. Logic probes
11. Etching machines complete with accessories
12. Coil winding machine, etc.

Drawing and Design Studio

1. Drawing tables and chairs
2. Drawing boards, T-squares and instruments
3. Automatic drafting machine
4. Drafting gadgets, stencils, etc

5. Automatic stencil cutter
6. Computer graphics and design hall with necessary design software (e.g. Fusion 360 (AutoCAD) software, SolidWorks**,** Solid Edge or equivalent
7. 3-D printer

Mechanics of Machines Laboratory

1. Free oscillation of point and distributed masses (Simple and Compound Pendulum)
2. Quick return mechanisms (Whitworth), Scotted line slider-crank, scoth yoke Geneva stop
3. Power transmission systems (belts, gears, shafts and clutches).
4. Coefficient of friction apparatus (belt, drive, slipping friction)
5. Free and force vibration of single degree of freedom systems with and without damping
6. Static and dynamic balancing systems
7. Power regulation (by Flywheel and Governors)
8. Demonstration of coriolis and centrifugal forces
9. Gyroscopic motion
10. Journal bearings
11. Vibration and Noise test set up.

Strength of Materials Laboratory

1. Apparatus for tensile, compression and torsion tests
2. Simple bending apparatus
3. Unsymmetrical bending apparatus
4. Impact tests apparatus
5. Elastic behaviour of thin- and thick-walled pressure vessels
6. Creep and fatigue
7. Theories of failure
8. Helical springs
9. Deflection of curved beams
10. Columns and struts
11. Strain gauging and photo-elastic behaviour.

Thermodynamics Laboratory

1. Temperature measurement apparatus
2. Power measurement apparatus (compressor, dynamometer etc)
3. Pressure measurement apparatus
4. Steam boiler
5. Equilibrium of mixtures of air and steam, quality of wet steam
6. IC engine apparatus
7. Calorific values of fuels
8. Analysis of products of combustion
9. Gas and bomb calorimeters
10. Gas and steam turbine apparatus
11. Heat-exchange apparatus
12. Free and forced convection heat and mass transfer systems
13. Thermal conductivity apparatus
14. Apparatus for the determination of radiative properties of materials
15. Jet propulsion systems

16. Vapour power cycles
17. Positive displacement engines and compressors
18. Refrigeration and Air-conditioning cycles

Fluid Mechanics Laboratory

1. Manometry
2. Hydrostatic forces on plane and curved surfaces
3. Forced vortex apparatus
4. Stability of floating bodies
5. Meter calibration and flow test set up
6. Hydraulic test benches
7. Nozzle and orifice flow apparatus
8. Laminar and turbulent flow in pipes
9. Friction loss in pipes
10. Heat losses in pipe fittings
11. Flow visualisation apparatus
12. Flow of fluid round bodies
13. Hydraulic power circuitry and measurement units
14. Reciprocating pump system
15. Centrifugal pump system
16. Pelton wheel
17. Resistance to motion of air through banks of finned and unfinned tubes
18. Calibration and performance of flow measurement devices
19. Subsonic wind tunnel and accessories
20. Supersonic flow apparatus

Metallurgy Laboratory

1. Apparatus for visualisation of atomic and crystal structures
2. Cooling curve apparatus
3. Simple metallography
4. Simple heat treatment apparatus
5. Apparatus for creep, hardness and fracture tests
6. X-ray crystallography equipment
7. Electric microscope
8. High power metallurgical microscope with camera unit

APPENDICES

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(During the period of development of the CCMAS)
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Perm. Sec. Fed. Min. of Health
Perm. Sec. Fed. Min. of Women Affairs & Soc. Dev.
Perm. Sec. Service Policies & Strategies Office, OHCSF

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(During the period of development of the CCMAS)
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List of Reviewers (NUC)

Title	Surname	First Name	Institution	Programme
Professor	FABORODE	Michael O.	Obafemi Awolowo University, Ile-Ife	**Discipline Chairman**
Professor	OLOCHE	O. B.	University of Abuja, Abuja	Mechanical Engineering
Professor	EKECHUKWU	Onyemaechi Valentine	University of Nigeria, Nsukka	Mechanical Engineering
Engineer	ALI	Kashim	COREN	Mechanical Engineering & General Discipline
Professor	OLORUNMAIYE	John Adesiji	University of Ilorin,	Mechanical Engineering

LIST OF SENATE COMMITTEE ON 30% INSTITUTIONAL ADDITION

Title	Surname	First name	Position
Professor	Oyedeji	Johnson	Chairman
Professor	Obasi	Rosemary	DAP, Member
Dr (Mrs.)	Odiachi	Rosemary	Ag. Librarian, Member
Professor	Oboh	Fred O. J.	Member
Professor	Ikhu-Omoregbe	Daniel	Member
Professor	Esimaje	Alexandra	Member
Professor	Obahiagbon	Kingsley Osaimiamiomwan	Member
Professor	Ajayi	Helen Inikpi.	Member
Professor	Oboh	Godwin	Member
Professor	Akpoghome	Theresa	Member
Professor	Enabulele	Stephen Amadin	Member
Professor	Asekome	Mike	Member
Professor	Enagbonma	Osato	Member
Dr	Erhunmwunse	Rapheal	Member
Dr	Ekwe	Joseph. N	Member
Dr	Okpoko	J.S.	Member
Dr	Imouokhome	James.I.	Member
Dr	Ajanwachukwu	W.	Member
Mr.	Ogbonna	Wilson	Member
Mrs.	Adekoya	Preye	Member
Mrs.	Eseiwi-Edokpolor	Eseiwi.G	Member
Mr.	Aruevbose	Enoma	Secretary

MECHANICAL ENGINEERING REVIEWER COMMITTEE, BENSON IDAHOSA UNIVERSITY

S/N	Name of Staff	Rank/Designation	Qualification, dates obtained and specialization, membership of professional association	Area of Specialty
1	Engr. Prof. D. I. Ikhu-omoregbe	Professor **Dean**	P*h.D.* Chemical Engineering (Birmingham, *1985)* M.Sc. Biochemical (Birmingham, 1982), B.Eng. Chemical Engineering (Benin, 1979) *MNSE, COREN*	Materials Science and Energy Technology
2	Engr. Dr. D.D. Olodu	Senior Lecturer HOD	PhD. (2017) Manufacturing Engineering, M.Eng (2013) Manufacturing Engineering, B.Tech (2005) Electro-Mechanical Engineering COREN (2018)	Design and Manufacturing
3	Dr. S.A. Omotehinse	Lecturer I	PhD. (2021) Industrial Engineering, M.Eng (2010) Industrial Engineering, B.Eng. (2005) Production Engineering	Production/Industrial Engineering
4	Engr. O.N. Aibangbee	Lecturer I	M. Eng. (2002) Industrial Engineering, B. Eng. (1998) Mechanical Engineering. COREN (2009)	Composite materials and Process Optimization,
5	Engr. Dr. O. Oghoghorie	Lecturer I	PhD. (2023) Manufacturing Engineering, M. Eng. (2013) Industrial Engineering, B. Eng. (2009) Mechanical Engineering, COREN (2016).	Industrial Engineering
6	Engr. F.U. Osaghae	Lecturer I	M. Eng. (2014) Mechanical Engineering, B. Eng. (1984) Mechanical Engineering COREN (2015)	Design and Manufacturing
7	Mr. G.O. Okagbare	Lecturer I	M. Eng. (2014) Mechanical Engineering, B.Eng. (2001) Mechanical Engineering	Design and Manufacturing