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FOREWORD

I warmly welcome all and sundry to the volume 3 issue 1 of Federal Polytechnic – Journal of Pure and Applied Sciences (FEPI-JOPAS) which is a peer reviewed multi-disciplinary accredited Journal of international repute. FEPI-JOPAS publishes full length research work, short communications, critical reviews and other review articles. In this issue, readers will find a diverse group of manuscripts of top-rated relevance in pure and applied science, engineering and built environment. Many of the features that you will see in the Journal are result of highly valuable articles from the authors as well as the collective excellent work of our managing editor, publishing editors, our valuable reviewers and editorial board members.

In this particular issue, you will find that Joseph and Adebajji provided innovative technology on light traffic control system. Ogunkoya and Sholotan engaged standard method for microbiological assessment of shawarma from Igbesa metropolis for possible microbial contamination. Ilelaboye and Kumoye unveiled the effect of inclusion of different nitrogen source on growth performance of mushroom. Ogunyinka et al utilized Fletcher Reeves conjugate gradient method as a robust prediction model for candidates' admission to higher institutions. Omotola and Fatunmbi examined the impact of thermal radiation with convective heating on magnetohydrodynamic (MHD), incompressible and viscous motion of non-Newtonian Casson fluid. Aako and Are meticulously investigated factors affecting mode of delivery using binary dummy dependent models. Abiazim and Ojelade successfully synthesized biologically active silver nanoparticles using *Terminalia catappa* bark as the eco-friendly source.

In addition, Olowosebioba et al. assessed the rectifying effects of various diodes in power supply units using multisim circuit design software programme. Olujimi et al. successfully accomplished the use of fingerprint based biometric attendance system for eliminating examination malpractices with enhanced notification. Alaba reported the nutritional status assessment of school age children (6-12 years) in private primary school in Ilaro. Muhammed-lawal et. al. assessed the execution and effect of corporate social responsibilities and return to marketing. Awolola and Sanni's research was about achieving quality of engineering education and training in Nigeria using Federal Polytechnic, Ilaro as the case study. Oladejo and Ebisin expatiated on virtual laboratory as an alternative laboratory for science teaching and learning.

Finally, Aneke and Folalu investigated the prospect and problems of the hotels in Ilaro, Ogun State.

I would like to thank and extend my gratitude to my co-editors, editorial board members, reviewers, members of FEPI-JOPAS, especially the Managing Editor, as well as the contributing authors for creating this volume 3 issue 1. The authors are solely responsible for the information, date and authenticity of data provided in their articles submitted for publication in the Federal Polytechnic Ilaro – Journal of Pure and Applied Sciences (FEPI-JOPAS). I am looking forward to receiving your manuscripts for the subsequent publications.

You can visit our website (<https://www.fepi-jopas.federalpolyilaro.edu.ng>) for more information, or contact us via e-mail us at fepi.jopas@federalpolyilaro.edu.ng.

Thank you and best regards.

E-Signed

Prof. Olayinka O. AJANI

FEPI-JOPAS VOLUME 3 ISSUE 1 TABLE OF CONTENTS

Serial No	Paper Title and Author(s)	Page
01.	<p align="center">INNOVATIVE TECHNOLOGY ON LIGHT TRAFFIC CONTROL SYSTEM.</p> <p align="center">¹Engr. E. A Joseph & ²Mr. S. A Adebajji ^{1,2}Department of Electrical/Electronic Engineering the Federal Polytechnic, Ilaro, Ogun State, Nigeria Phone/WhatsApp No: ¹08057023944; ²08039535936 e-mail: ¹adelekejoe12@yahoo.co.uk; ²divineabbey01@gmail.com</p>	1-7
02.	<p align="center">MICROBIOLOGICAL ASSESSMENTS OF “SHARWAMA” A READY TO EAT STREET FOOD IN IGBESA, OGUN STATE, NIGERIA</p> <p align="center">Ogunkoya, Wole Adepero</p> <p align="center">Department of Science Laboratory Technology Ogun State Institute of Technology, Igbesa, Ogun State. Corresponding author: +2348107087482 ogunkoya.adepero@gmail.com</p>	8-13
03.	<p align="center">EFFECT OF INCLUSION OF DIFFERENT NITROGEN SOURCES IN VARIOUS SUBSTRATES ON GROWTH PERFORMANCE OF MUSHROOM (<i>PLEUROTUS PLUMONARIUS</i>)</p> <p align="center">*Ilelaboye N.O. and Kumoye D.E. Department of Science Laboratory Technology, The Federal Polytechnic Ilaro *nasir.ilelaboye@federalpolyilaro.edu.ng. 08137657580</p>	14-21
04.	<p align="center">A Robust Prediction Model for Candidate’s Admission using Fletcher-Reeves (FR) Conjugate Gradient Method</p> <p align="center">Ogunyinka, T. K., Dada I. D., Oni, O. O. & Ayemowa, M. O. Department of Computer Science, Gateway (ICT) Polytechnic Saapade-Remo, Ogun State. ✉tkogunyinka@yahoo.com</p>	22-31
05.	<p align="center">Modeling Mode Of Childbirth Delivery Using Dummy Dependent Variable Models</p> <p align="center">Aako, O. L. ✉, Are, S. O. Mathematics and Statistics Department, Federal Polytechnic, Ilaro, Ogun State, Nigeria ✉ olubisi.aako@federalpolyilaro.edu.ng.</p>	32-37
06.	<p align="center">Green Synthesis of Silver Nanoparticles Using <i>Terminalia catappa</i> Bark Extract and Its Antibacterial Activity</p> <p align="center">Abiazem, C. V. & Ojelade, I. A. Department of Science Laboratory Technology,</p>	38-44

FEPI-JOPAS VOLUME 3 ISSUE 1 TABLE OF CONTENTS

	<p><i>Federal Polytechnic Ilaro, Ogun state, Nigeria</i> <i>vyvycox@yahoo.com</i></p>	
07.	<p style="text-align: center;">Magneto hydrodynamic Radiative Casson Fluid Motion Past a Convectively Heated and Slippery Non-linear Permeable Stretching Plate</p> <p style="text-align: center;">E.O. Omotola, E. O. Fatunmbi <i>Department of Mathematics, Federal Polytechnic, Ilaro, Nigeria</i> ephesus.fatunmbi@federalpolyilaro.edu.ng</p>	45-55
08.	<p style="text-align: center;">Assessment of Rectifying Effects of Various Diodes in Power Supply Units Using Multisim Circuit Design Software Programme</p> <p style="text-align: center;">Olowosebioba, A.A., Odunaike, R.K., Akingbade, F.S. <i>Department of Science Laboratory Technology, Ogun State Institute of Technology, Igbesa, Ogun State</i> ☒ wolowoelectro@yahoo.com</p>	56-66
09.	<p style="text-align: center;">A Fingerprint Based Biometric Attendance System for Eliminating Examination Malpractices with Enhanced Notification</p> <p style="text-align: center;">Olujimi, O. O., Aderemi, T. A., Taiwo, K. O., Adeleke O. A. <i>Department of Computer Science, Gateway (ICT) Polytechnic, Saapade, Ogun State.</i> ☒ oniolujimi@gmail.com</p>	67-74
10.	<p style="text-align: center;">ASSESSMENT OF NUTRITIONAL STATUS OF SCHOOL AGE CHILDREN (5-12 YEARS) IN SELECTED PRIVATE PRIMARY SCHOOLS IN ILARO METROPOLIS OGUN STATE. NIGERIA.</p> <p style="text-align: center;">ALABA, K. E. <i>Department of Nutrition and Dietetics, School of Pure and Applied Sciences</i> <i>The Federal Polytechnic, Ilaro, P.M.B 50, Ilaro, Ogun State, Nigeria.</i> ☒ kikelomo.alaba@federalpolyilaro.edu.ng</p>	75-81
11.	<p style="text-align: center;">Virtual Laboratory: An Alternative Laboratory for Science Teaching and Learning</p> <p style="text-align: center;">Oladejo, A. I. & Ebisin, A.F. ☒ <i>Africa Centre of Excellence for Innovative and Transformative STEM education, Lagos State University, Ojo</i> gbadegeshin86@gmail.com <i>Ogun State Institute of Technology, Igbesa</i> ☒ ebironke16@gmail.com</p>	82-91
12.	<p style="text-align: center;">Achieving Quality of Engineering Education and Training in Nigeria: The Federal Polytechnic, Ilaro as a Case Study</p>	92-97

FEPI-JOPAS VOLUME 3 ISSUE 1 TABLE OF CONTENTS

	<p style="text-align: center;">Awolola, O. O[✉], Sanni, E.O <i>Department of Mechanical Engineering, The Federal Polytechnic, Ilaro, Ogun State.</i> ✉ olalekan.awolola@federalpolyilaro.edu.ng</p>	
13.	<p style="text-align: center;">Saw Millers Corporate Social Responsibilities and Returns to Marketing</p> <p style="text-align: center;">Muhammed-lawal, A.A., Lawal, R. A. & Ogunseitán, T. O. <i>Department of Agricultural Technology, Federal Polytechnic Ilaro, Ogun State, Nigeria.</i> ✉ lawaz71@yahoo.com; raimot.lawal@federalpolyilaro.edu.ng</p>	98-107
14.	<p style="text-align: center;">Investigating the Prospect and Problems of the Hotels in Ilaro, Ogun State Nigeria. Aneke F.O., Folalu A.A. <i>Department of Hospitality Management, The Federal Polytechnic Ilaro, Nigeria</i> ✉ omobolanle202@gmail.com</p>	108 -112

Achieving Quality of Engineering Education and Training in Nigeria: The Federal Polytechnic, Ilaro as a Case Study

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Abstract

This trend persists despite the availability of regulatory agencies and professional bodies in engineering for the regulation of engineering education and training in these institutions. In order to establish the cause(s) of poor quality of engineering education, the various areas of monitoring the training which includes curriculum delivery, facilities and the faculty, stakeholders and industrial partnership must be examined. This paper, therefore, looks at the internal mechanism adopted by the authorities of The Federal Polytechnic, Ilaro towards achieving the delivery of quality graduates and continuous accreditation of its academic programmes. The Quality Assurance Committee reports of the institution for five academic sessions together with the results from the study show that there is adequate attention to the provision of adequate minimum equipment needed for the effective running of engineering programmes. From the study, it became evident that the Quality Assurance Committee of the institution has a positive effect on the quality of engineering education and training in the institution. Therefore, it is concluded that all hands must be on deck for *running a viable engineering education*.

Keywords: Quality Graduates, Engineering Education, Continuous Accreditation, Regulatory Body

INTRODUCTION

Nigeria is a country of about 200 million people (Akinyemi & Isiugo-Abanihem 2014). The number of institutions is equally in the increase though it might not have been matched or in proportion to the population of the country. At the end of every academic session, graduates are turned out in their hundreds of thousands and made to undergo the mandatory one-year National Youth Service. There are unsatisfactory comments regarding the quality of graduates from tertiary institutions especially by the employers of labour (Aminu, 2019). Some graduates had been reported to be unemployable as a result of failure to complete employment Biodata Form (Lowden et al, 2011). This is no doubt a worrisome situation to the stakeholders in the Educational Sector of the country. The quality of graduates has much to do with the quality of processes that produces the graduate. Such processes include meeting the prescribed entry requirements and good performance in the entrance/screening examinations.

Li(2017), in his work on the mechanism of quality assurance in engineering education using Purdue University as a case study, concluded that quality assurance in engineering education plays a significant

role in cultivating engineering aptitudes around the world. Achieving quality engineering education in tertiary institutions in Nigeria starts from the subject combination that is expected from admission seekers. The skills expected is majorly based on the analytical aptitude of the candidates and upon admission series of training, processes are put in place for the students to be well-groomed and grounded in the area of preference in engineering.

Engineering education spans through technical schools, technological institutions and universities (Faborode, 2013). In Nigeria, the regulatory body for Universities in the National University Commission (NUC) and Technical Colleges, Polytechnics and Colleges of Technology, the regulatory body is the National Board for Technical Education (NBTE). These regulatory bodies are established and mandated to regulate the curriculum delivery in these institutions to produce quality graduates that can compete favourably with other counterparts around the globe. Although these regulatory bodies are doing their best within the resources available to them, it is important to emphasize that proprietors of tertiary institutions particularly governments at federal and state levels have an enormous role to play in enhancing the quality of graduates in terms of adequate funding.

Falade (2013) expatiated on those key factors that are of great importance to achieving quality engineering education which includes: Teaching and learning styles

is less effective against the prevailing challenges in the learning environment. For effectiveness in teaching and learning, he advocated active learning strategies with computer applications in the individual, team and research-based learning should be constantly reviewed to enhance the effectiveness of the teaching and learning process. Also, education funding in this part of the world still falls below 26% of the National Budget as recommended by UNESCO. The quality of education is dependent on the extent of funding. As a result of the paucity of funds, educational resources and other facilities available are inadequate to provide the desired human capacity and physical development towards the production of quality graduates in the country. Evidence of poor or funding is abounding in the Libraries with the insufficient stock of journals, textbooks, e-learning resources, ill-equipped workshops, laboratories and studios, poor remunerations (salaries) of the workforce and low motivations resulting in rampant brain drain. Another challenge is physical infrastructure for training of engineering personnel this challenge mitigating the quality of graduates from the tertiary institutions is the poor physical infrastructure on the ground concerning classrooms, laboratories, workshops, libraries, and staff offices. Evaluations and assessments: he deplored the present method of evaluation which is cumbersome most especially in a very large group of students where scores in class attendance, tutorials, laboratories, workshops exercises, class assignments constitute Continuous Assessment coupled with projects and final examinations for grading the students, He advocated a technological driven assessment and evaluations techniques for better outcomes.

Nigerian Tertiary Education in the last few decades has witnessed some forces of globalization, as demonstrated in higher expectations to provoke robust improvement in technology, economy, and other elemental variables. Quality Control and Quality assurance in Engineering Education, has remained a viable catalyst in actualizing these expectations. Emeasoba (2015) opined that the quality and degree of technological and economic development of a nation is premeditated by the quality of its Engineering graduates and Engineering practices, which could also be a weakness of that nation. The ideology of quality Engineering training and education should accommodate, the integration of well-organized apprenticeship with the academic program as applicable in all cadre (Nnadi, 2000). However, it is safe to say young Engineers in the country are half-baked and unemployable. The focus of successive

that is the old pedagogical method of reading out to students to take notes

governments has rested on other fields of contention to the nation than Engineering.

The entirety of characteristics of an academic program and its provider, via which the expectations of the beneficiaries and the quality standard are met, is simply put as the quality of technical education in Nigeria's education system (Emeasoba, 2015). The term quality in technical education is synonymous with the actualization of training outcomes, which among others are competence, knowledge, and skills gleaned after the training process. It is no longer strange to say that the quality of Nigerian tertiary education is dwindling.

Emeasoba(2015) was of the view that Quality assurance for engineering academic program is conducted at different cadres in Nigeria tertiary institutions; on semester basis: question papers, final year student's projects are accessed by experienced academic personnel invited as an external examiner from other tertiary institutions; as per interval: the National Board for technical education (NBTE) and National University Commission (NUC), on a regular occasion, use experienced academic personnel to carry out accreditation exercises for all engineering disciplines in the tertiary institutions, regulatory bodies such as the Council for the Regulation of Engineering in Nigeria (COREN), timely through a mechanism of visitation, accreditation, re-accreditation of programs, ensure sustenance of standard in tertiary institutions; accreditation: this is a check and balance carried out by statutory bodies to ensure the institution is fit to run engineering programs vis-à-vis breed competent engineers, ensure compliance to standard practices in all disciplines rendered by tertiary institutions, gazette tertiary institutions that meet the minimum requirements laid down by National Board for Technical Education (NBTE) and National Universities Commission (NUC) for programs offered to the Nigerian community, offer advice and support to the proprietors of tertiary institutions, as the case may be; academics Programme Certification: approval must be granted by NBTE and NUC for new programs in all tertiary institutions before they are kick start, they are already established protocols and application templates by NBTE and NUC to this effect, final approval is granted through the sufficiency of readiness and thorough resource assessment.

It is no doubt that the quality of Nigerian Engineering graduate is fizzling out, leading to a generation of young graduates dearth of the technical competence needed for today's industrial needs, and the world of

work in general. (Olorunfemi & Ashaolu, 2008) thought that Nigeria is far from witnessing technological explosion and economic advancement, as a result of the dilapidated facilities crippling the nation's tertiary institutions, and the plethora of young graduates from various institutions of higher learning who were unable to convert the economic advantage of the nation towards industrialization. These attest to the fact that the engineering education in the country's tertiary institutions has been greeted by enormous challenges, which must have led to these antecedents. Some of these challenges are as follows:

Silveira (2016) maintained that traditional science education such as; medicine, psychology, management, art, etc., is quite a different type of education compared to Engineering education. Also, (Ye & Lu, 2011) stressed that the development of creativity in students through engineering education holds great importance, for which practical education is accorded immense value, in the light of the above, synergy between Engineering institutions and the industries is necessary for the grooming of engineering students. Tertiary institutions in the developed countries as asserted by the American National Academy of Engineering, as the major drivers of cutting-edge technology from the industries, and the economy in general (Silveira, 2016). The synergy between institutions of higher learning and the industries is a pivotal agent of an economic explosion, which suffices through various means such as temporal exchange of researchers; consultancy services; Joint research work by scientist and engineers, academia enjoy contracts and research grants for publications, seminars, conferences, etc. from the industries; faculties, recruiting of students engineers by industries, graduates, in other instances major players of the industries are inducted into the advisory council in some tertiary institutions, which engenders promotion of technology and science, but in Nigeria tertiary institutions system, such dynamic collaboration between academia and industries is unequivocally absent (Onwuka, 2009).

Funding or resource allocation to the educational sector of a country would go a long way to the actualization of the purposes of establishment of tertiary institutions, which includes; teaching, research, and community services. In an article by Ojodo (2002), posited that 'some Engineering Schools have degenerated to mimic level', 'the facility situation in our colleges of Engineering is pathetic and must be addressed' and 'our universities are not well funded.' Inadequate resource allocation to the tertiary institution of a country could be tag as an expression of her outright lack of seriousness to educational development. It aligned with these anomalies that (Akintoye, 2018) maintained that, successive Nigerian governments in the last few decades have been unable to implement the United

Nations Education and Scientific Organization benchmark of 26 % of the national budgetary allocation to the education sector. Consequently, the underfunding of the country's institutions of higher learning has had a debilitating effect on the quality of engineering education. It was asserted by Abdussalam, (2019) that 6.7 % of Nigeria National budget for the year 2020 was allocated to the education sector, which summed up to ₦691.07 billion. This reflects utter negligence to the education sector, with attending gross negative consequences.

The Engineering Curriculum requires constant review and updating to meet modern challenges in the industries globally.

There is a big gap between the curriculum and what is obtainable in the real world of work. Both the theoretical and practical contents of engineering-based courses are no longer adequate to address these modern challenges. The little practical content available could not be achieved due to obsolete or lack of equipment or tools. For example, the world has left the system of mechanical machining to numerical controlled types such as CNC. Tolubi (2013) posited that the curriculum should be one that will produce graduates with skills ready for the global market with much relevance, readiness and dexterity in business methods, finance and leadership.

The Council for the Regulation of Engineering in Nigeria (COREN) is a statutory body established by the Government for the regulation of engineering education and practices in Nigeria. In the Polytechnic Education Sector, the National Board for Technical Education (NBTE) in conjunction with COREN carries out accreditation of academic programmes in Technical and Vocational Education (TVE) Institutions towards ensuring appropriate training for engineering personnel for the award of Technical Certificates, National Diploma and Higher Diploma Certificates (Kashim, 2015). The engineering curriculum in operations in tertiary institution rolled out by regulatory bodies are the minimum expected standard to be attained and it is expected by the curriculum handlers to update this time to time to be inconsonant with technological trends. Every engineering programmes are accredited every five years by the regulatory bodies and any institutions not attaining the required standard are either scrapped or decline reaccreditation.

There are one hundred and seven (107) polytechnics/monotechnics institutions in Nigeria under the supervisory of NBTE (Number of Polytechnics in Nigeria, 2020). The Federal Polytechnic, Ilaro is one of such polytechnics. It was established by Decree No. 33 of July 25, 1979. Presently the Polytechnic has five (5) Schools namely:

School of Communication and Information Technology, School of Engineering, School of Environmental Studies, School of Management Studies and School of Pure and Applied Science. The School of Engineering is the oldest with the following academic departments: Agricultural & Bioenvironmental Engineering (ABET), Civil Engineering (CE), Computer Engineering (CTE), Electrical/Electronic Engineering (EE), Mechanical Engineering (ME), Mechatronics Engineering (MCE), Welding & Fabrication (WFE). These engineering departments are interrelated and do share equipment which help in achieving thorough training of students through practical and researches. The departments run academic programmes at either or both the National Diploma (ND) level or/and Higher National Diploma (HND) level that are fully accredited by the National Board for Technical Education (NBTE)

For the achievement of the needed quality of education, there are laid down requirements for assessment by NBTE which include curriculum delivery (theory and practical work), moderation of both examination questions and answer scripts. These are the key focus areas of accreditation to check if the minimum standards are attained as set by NBTE

To achieve all-round quality education at The Federal Polytechnic, Ilaro, the Academic Board of the Institution set up the Quality Assurance Committee with the following Terms of Reference:

- To ensure conducive teaching and learning environment,
- To monitor adequate coverage of syllabus and attendance of both lecturers and students,
- To collect evidence of the practical work conducted by each department, and
- To note the level or extent of practical work coverage in practical based courses in each of the departments

The Committee was saddled with the responsibility of achieving qualitative education for the students which in turn guarantees stress-free accreditation by Government or Professional regulatory bodies.

The Terms of Reference as stated above guide the Quality Assurance Committee in the accomplishment of its assignment. Membership of the Committee cuts across all the five (5) schools in the institution. The report of the Committee is submitted to the Academic Board at the end of each Semester for consideration and necessary action.

MATERIALS AND METHODS

The reports of eleven (11) semesters were obtained from the archives of the Institution Quality Assurance Committee. The reports comprised of First and Second Semesters of the following Academic Sessions: 2011/2012, 2015/2016, 2016/2017, 2017/2018 and 2018/2019 while only the Second Semester was considered for the 2014/2015 Academic Session. In the report, the findings of the School of Engineering were studied and narrowed to the Department of Mechanical Engineering being the department of these researchers. The observations and recommendations for the period in question were identified and later found out that the action(s) taken by the Management of the institution greatly assisted the department in securing NBTE accreditation of all the programmes run at both the ND and HND levels in the department. This was no deficiencies in equipment as expected in the minimum equipment required to run each programme which was different from what was obtainable before the inception of the quality assurance committee in which both ND and HND programmes of the Department were denied reaccreditation in 2008 accreditation.

RESULTS AND DISCUSSION

The extracts from the reports of the Quality Assurance Committee with respect to the Department of Mechanical Engineering are presented in Table 2. The activities of the Quality Assurance Committee as regards its visitation to department are discussed below:

Components of Practical works carried out – the number of practical exercises carried out in practical based courses in the programmes available in the Department of Mechanical Engineering is in line with the number expected to be performed as observed from the NBTE curriculum for each of the programmes which both the trainers and trainees adhered to except in few exceptions where the situation at hand could not be helped. On the average, the percentage practical coverage is still considered sufficient as the NBTE Accreditation Team had not found wanting even in the recent accreditation where all the programmes in the Department were reaccredited.

Table 2: Overall Assessment of Practical Works for the sessions indicated

Session	Semesters	Programmes		Remarks
		ND	HND	
2011/2012	1 st	100	87.3	Interferometer, gear measurement apparatus and angle Deckor are needed
	2 nd	94.6	92.3	Due to faulty equipment (steam power plant, 4-stroke diesel and petrol) no experiment could be carried out on MEP 321; (b) orifice meter, venturi-meter & V-notch are required in fluid mechanics lab; (c) Torsion testing apparatus, fatigue testing and creeping testing apparatus are needed in strength of materials lab
2014/2015	1 st			
	2 nd	100	100	
2015/2016	1 st	100	91.8	Heat exchanger etc. are required for energy conversion and heat transfer
	2 nd	99.3	97.2	
2016/2017	1 st	91.7	91.8	
	2 nd	98	96.3	A central strength of materials lab was proposed for both Departments of Civil and Mechanical Engineering
2017/2018	1 st	100	92.7	
	2 nd	98.5	89.3	Thin & Thick cylinder apparatus is required for strength of materials experiments
2018/2019	1 st	97.1	92.9	
	2 nd	100	96.9	Electricity should be constant at the machine shops so as to carry out workshop activities

Components of facilities for Practical works carried out – there are challenges of facilities for practical or laboratory works which could be seen in the column of the remark in the Table 2. However, in most of the cases the department makes do with what is available most especially prototype of the needed facilities would have been used for projects and these were put into good use for passing the needed knowledge to the students no matter how minute. This has in no small measure helped to achieve the needed quality in terms of practical work and in particular the delivery of the curriculum. In the 2017/2018 Academic Session the following equipment; Torsion testing apparatus, fatigue testing and creeping testing apparatus were procured for the Strength of Materials Laboratory. In the same period a joint Central Strength of Materials Laboratory established in the School of Engineering based on the recommendation of the Quality Assurance Committee.

Components of infrastructures for Practical works carried out – there are little or nothing that could be achieved if there is electricity challenges which would hamper the conduct of practical exercises, nevertheless,

this is ameliorated by alternative power supply from the power generating sets installed by the institution. Recently, a 250KVA Power Generating Set was procured and installed in School of Engineering for the conduct of practical works in the workshops, laboratories and studios within the School.

Research during the pandemic (COVID 19) – when the corona virus broke out early 2020 and there was lock down, it was the availability of appropriate equipment and tools in the engineering departments which make the making of novel equipment such as ventilator feasible during the period which was applause in the country.

CONCLUSION

There is a great need to achieve quality in the delivery of engineering education curriculum for national development and technological dependence. For the achievement of this quality, no stone must be left unturned in area of practical delivery and all stakeholders must live up to expectations in terms of funding, regulation and provision of an enabling environment for teaching, learning and research. The

quality of engineering education cannot be divorced from the availability of modern training facilities and opportunities for human capital development which can only be achieved through adequate funding. It is to be noted that the Quality Assurance Committee of The Federal Polytechnic, Ilaro has in no measure, through its recommendations to the Management, improved the quality of engineering education and engineering graduates from the institution.

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