PRODUCTION BASED EDUCATION FOR PERSPECTIVE EXCELLENT FUTURE: AN OVERVIEW

Mr. Sushil Kumar Swar, Mr. Sanjay Prabhakar Dikshit,
Mr. Ravindra Nanasaheb Vaidya, Mr. Sanjay Rangrao Deshmukh
(Civil Engineering Department, Government Polytechnic Nashik, Maharashtra, India)

ABSTRACT

Manufacturing sector plays an important role in national as well as global economy. The competitiveness of national manufacturing requires highly educated and motivated workforces as their capability are also critical to the future viability of national manufacturing sector. Consequently, a manufacturing education is needed to be constructed as one of major drivers that can play a significant role in promoting excellence for manufacturing, leveraging competitive advantage of the industries as well as for levelling up national economic in order to cope with global challenges in the years to come .The practice of manufacturing education in Indonesia to some extent and other countries has been carried out separately and independently from industry. PBE is one of promising models in manufacturing education as it is able to address a number of emerging challenges related to industry, academia and the society in general (including government); as well as to comprehend the implementation of knowledge transfer to maintain technological excellence in industry. PBE promotes and develops competency and professionalism that can be used as a strategic framework for promoting productive teaching and active learning at technical education in general.

To overcome the mentioned educated employment, we offer an alternative solution to integrate production based with the learning process; the outcome would be the entrepreneurial ability of the engineering students. The results of this study showed that the implementation of production based learning with entrepreneurship approach using workshop based lectures, qualitatively improved the quality and meaningfulness of the learning. The learning experience which connects the interns and the works or work products is indeed in line with the field specification and standard. The learning process has given impact to the entrepreneurial interest improvement assessed in the beginning and at the end of the semester. Besides that, the learning activity gives impacts to the cognitive discourse, psychomotor skill, and work attitude improvement build integrally. [This paper focuses on overview of papers on production based education and can be utilized to improve the students learning skills for excellent prospective future] .

Keywords: Production Based Education (PBE), learning, production, entrepreneurship.

INTRODUCTION

This collaboration concept between academia and industry called Production Based Education (PBE), as model of education program that aimed to provide workforces with new competencies and qualifications that suit for the new manufacturing generation. Providing exact learning media helps university or polytechnic to achieve student competencies always relevant to what the industries asked and validate the education process, since its products/ services are always pushed to meet the industrial need. Moreover, educational activity collaboration with industrial demand for the students kept an adequate loading works, and from other side industrial customers could utilize the educational institution capacity and capability as one of their vendors role to produce or develop product for supporting their needs . With industrial style of order handling setup in the organization, all customers 'inquiry that agreed to be produced will be followed up in proper and professional way, therefore the QCD (quality-cost-delivery) necessity for the customers are embedded in the system. In manufacturing field, 'job shop' is the common type of product for students practical media due to its wider challenges and flexibility for variety requirements, therefore the facility design of workshop/ laboratory is made to this type of product. There are more things could be learned in tools project besides machining or fabrication process skill only. Entrepreneurship is separated from the world of education. Thus to be able to continue learning, University needs alternative solutions by integrating the value on entrepreneurship in the learning process through the development of production-based learning model. The concept is being offered in the learning process for each material whereby University students are able to produce products that are innovative and creative as well as acceptable for the market through the stages of logical and meticulous analysis, which further processed into creative new ideas, innovative and accepted in the market both in terms of planning skills, decision skills & execution skill. The development of production-based learning model will be able to enhance the entrepreneurship passion of the students and graduates of the Faculty of Engineering.

METHODOLOGY

Analogized with IPO (input-process-output) concept, learning process of Tools Project had common '5M' for input and support or adder. Except product, there are also skills, competencies and experiences -either for students and lecturers- as its output, as shown on "Fig. 1".

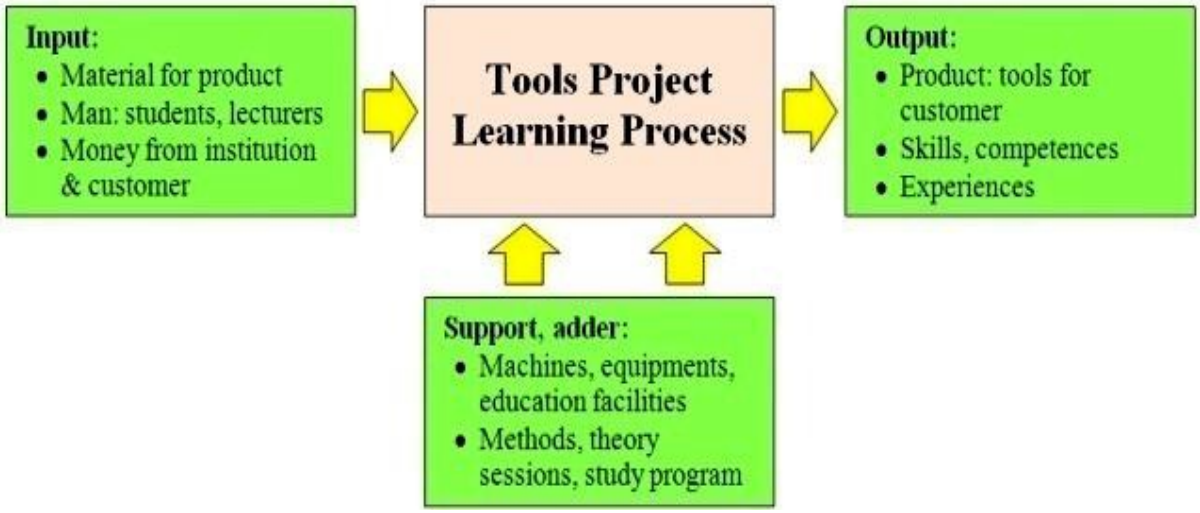

Figure 1. IPO Concept in Tools Learning

In Diploma-3 (D3) program that had 6 semesters period, this Tools Project is scheduled on semester 4 and 5 where '321' program concept is adopted. This 321 program idea stated that students will get the first 3 semesters for basic matters needed, the next 2 semesters in integrated project program continually and the last 1 semester for finalization and the additional enrichment items. Basically, instead of doing machining or other learning process respectively, on this semester 4 & 5 of '321' a few subprograms are defined with no interrupting with any theory week or surrounding from one kind of machine program to another.

IPO COMPONENTS IN TOOLS PROJECT LEARNING

Diploma-3 (D3) program that has 6 semesters or 6 terms of period adopted '321' concept, where on semesters 1,2,3 -as the first 3- and semester 6 -the last 1 semester- the program schedule is arranged respectively with 2 weeks for practical and 1 week theory session by turns. Semester 4 and 5 are defined for integrated project program continually, no interrupting with any theory week. Since special tools like stamping dies, injection moulding or fixture are categorized in job shop that met with the policy and facility design, this kind of product is used for learning education process on semester 4 and 5.Analogizing IPO (input-process-output) concept, learning process of Tools Project had common '5M' for input and support or adder whereas product, competencies and experiences -either for students and lecturers- as its output.

	Month-1				Month-2				Month-3				Month-4				Month-5				Month-6			
Group A	BV	BV	JS1	JS2	JS2	D	D	D	M	P	P	P	P	P	P	P	P	A	A	PR	PR	PR	PR	E
Group B	JS2	JS2	BV	BV	PR	PR	PR	PR	D	D	D	M	P	P	P	P	P	P	P	P	A	A	JS1	E
Group C	D	D	D	M	P	P	P	P	P	P	P	P	A	A	PR	PR	PR	PR	JS1	JS2	JS2	BV	BV	E
Group D	PR	PR	PR	D	D	D	M	P	P	P	P	P	P	P	P	A	A	JS1	PR	BV	BV	JS2	JS2	E

- BV = bench vice product, in Batch lab
- JS1 = Jobshop Lab, external customer's job
- JS2 = Jobshop Lab, external customer's job
- PR = Research Project Lab, internal customer's job
- D = design, drawing (Tools Project, TP)
-M= component & material preparation (TP)
- P = machining process (TP)
- A = assembly (TP)

Figure 2. Example of Practical Work Schedule For Semester 5.

"Fig. 2" is a simplified example program schedule in semester 5. One of shown subprogram is a 'tools project' for each subgroup (A, B, C and D) that composed -in this case- for 6 students, since 1 group consists of 24 students. 'Tools Project' sub program consists of design, material preparation and floor shop executing such as machining and assembly.

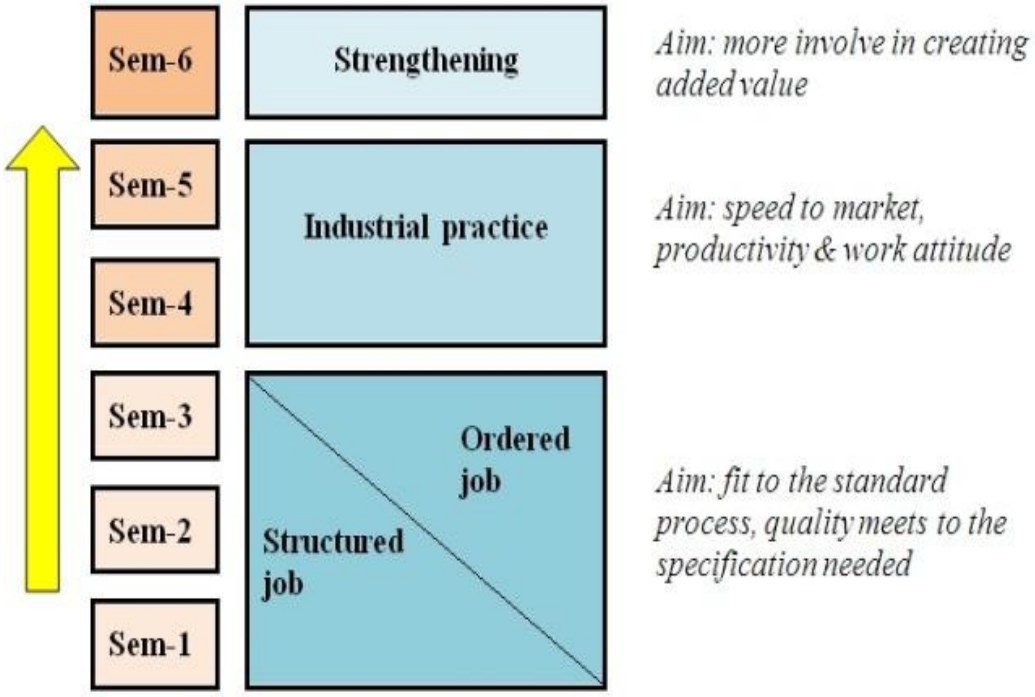

Figure 3. Program phases in education process

In ‘material preparation’ case students play the role as the assistance of their lecturer in PPC (production planning and control) tasks, such as ordering standard part and material to the warehouse, controlling the coming material either in quantity or technical specification, checking the actual machining schedule, etc. With this model of education, students learn not only processing skills but also introduced to other related production and project management issues. As mentioned, Diploma-3 (D3) education program developed based on three phases arrangement that described by “Fig. 3”. ‘Problem-Based’ on semester 1 to 3 is started using standard product as a structured job to train the student in basic competencies fit to the standard with low-mid speed and ordered job in deepening a competences for more speed in delivering a product to the industry as a customer . ‘Industrial Practice’ as second phase on semester 4 and 5 is operated as the real industry where students are working full time for 1 year or 2 semesters, as mentioned previously, according to daily industrial problem where the Tools Project is in. Last semester is used for finalization/ strengthening remain planned matters, additional enrichment items and D3 final exam preparation.

REVIEW ABOUT THE PASSION FOR ENTREPRENEURSHIP

A person’s passion for entrepreneurship can emerge after going through a process influenced by internal factors such as internal motivation, the spirit of working hard, and other positive potentialities. According to Suranto (2012) a student entrepreneur passion is having the ability to see opportunities, are professional, and with the following characteristic: (a) able to write well; (b) the entrepreneurial awareness; (c) the spirit of entrepreneurship; (d) explore the advantages and covering their drawbacks; (e) has a business network and building access to the other party; (f) have the mental self help; (g) creative and innovative; (h) self-confidence; (i) the tenacious and diligent; (j) do not easily give up. Furthermore Puspitasari (2007) stated that entrepreneurial spirit is the passion and the entrepreneurial attitude at the start of the process of creative, innovative people who have an entrepreneurial spirit and attitude, characterized by the attitude of the confident, optimistic, full of initiative, commitment, results-oriented, energetic, insightful, brave leadership, appear different, dare to take risks, and be ready with a challenge. While according to Dadang (2008) an entrepreneur is a person with "the skill to convert dirt and wrecks into gold”.

Based on the background and the outline of the problem, the research conducted is a developmental research. This includes research to develop and produce new products in a system of learning that will be applied to learners as a user (users). Needs analysis was

conducted which includes an analysis of the learning infrastructure and facilities, the needs of students, student characteristics, analyze the ability of educators to face obstacles during learning. Main concepts for the research were set by the researchers and educators integrate them in their lectures.

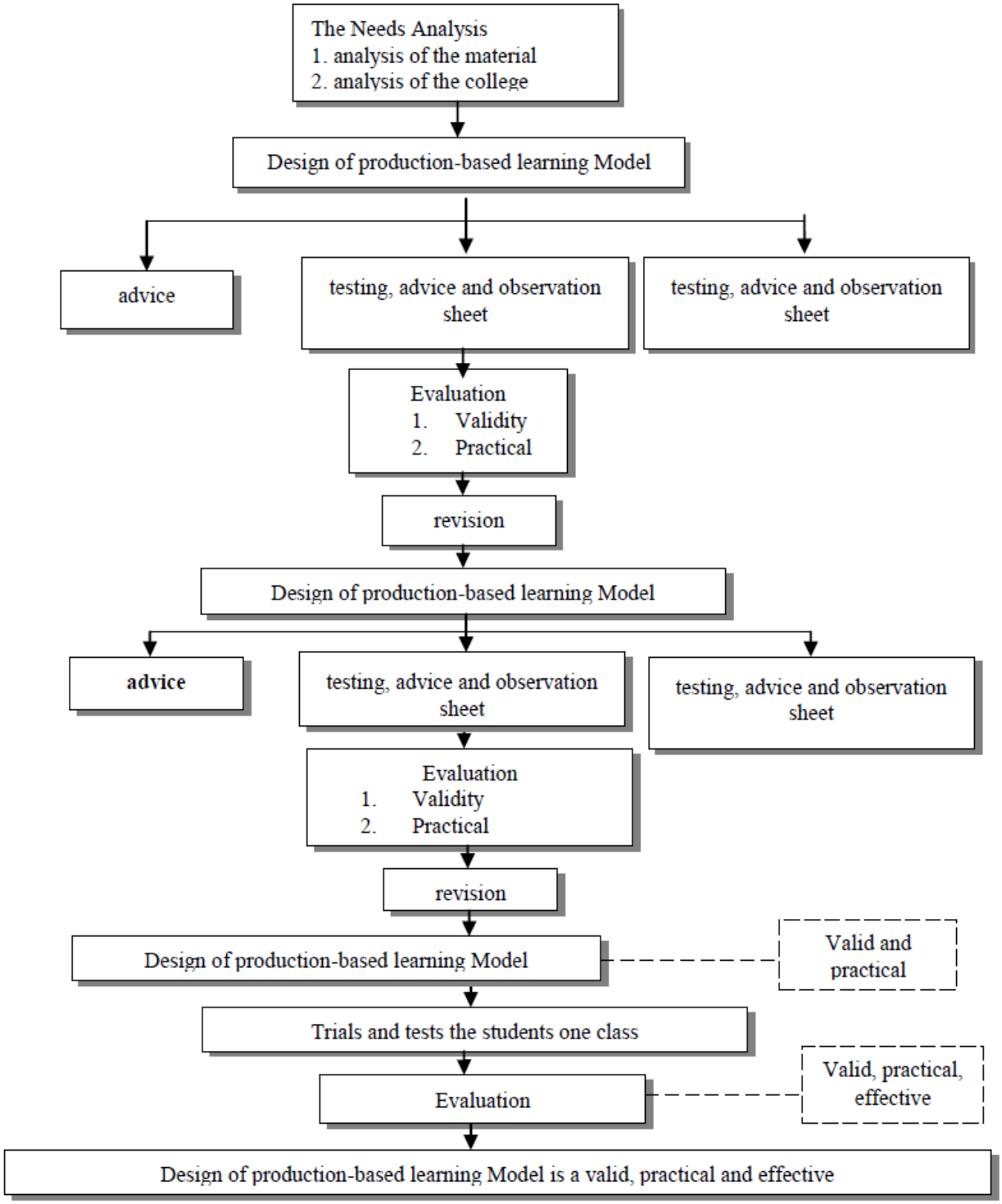

Figure 4. Diagram of the stages of the development of production-based learning model (Adapted from Akker,1999)

The research was conducted on electric circuit teaching courses from January – June 2013. In the evaluation stage, educators and students answered a questionnaire and an observation sheet given to them. The research was implemented in two stages a limited group test and a large group test which aim to see the practicality and effectiveness of the products developed. Responses regarding the suitability of the products were obtained after the students gave their response based on suggestions and feedback for correction of the product. The procedure for the development of production-based learning model is as follows in Figure 4. The production-based learning model as in Figure 5 developed is effective when practice in the teaching of students from electrical engineering education program of Faculty of Engineering . The practicality of this model reflects the ease in implementation for the students, as illustrated in Figure 5. In this model, student are required todevelop creativity and innovation so that the resulting products have added value and renewable.

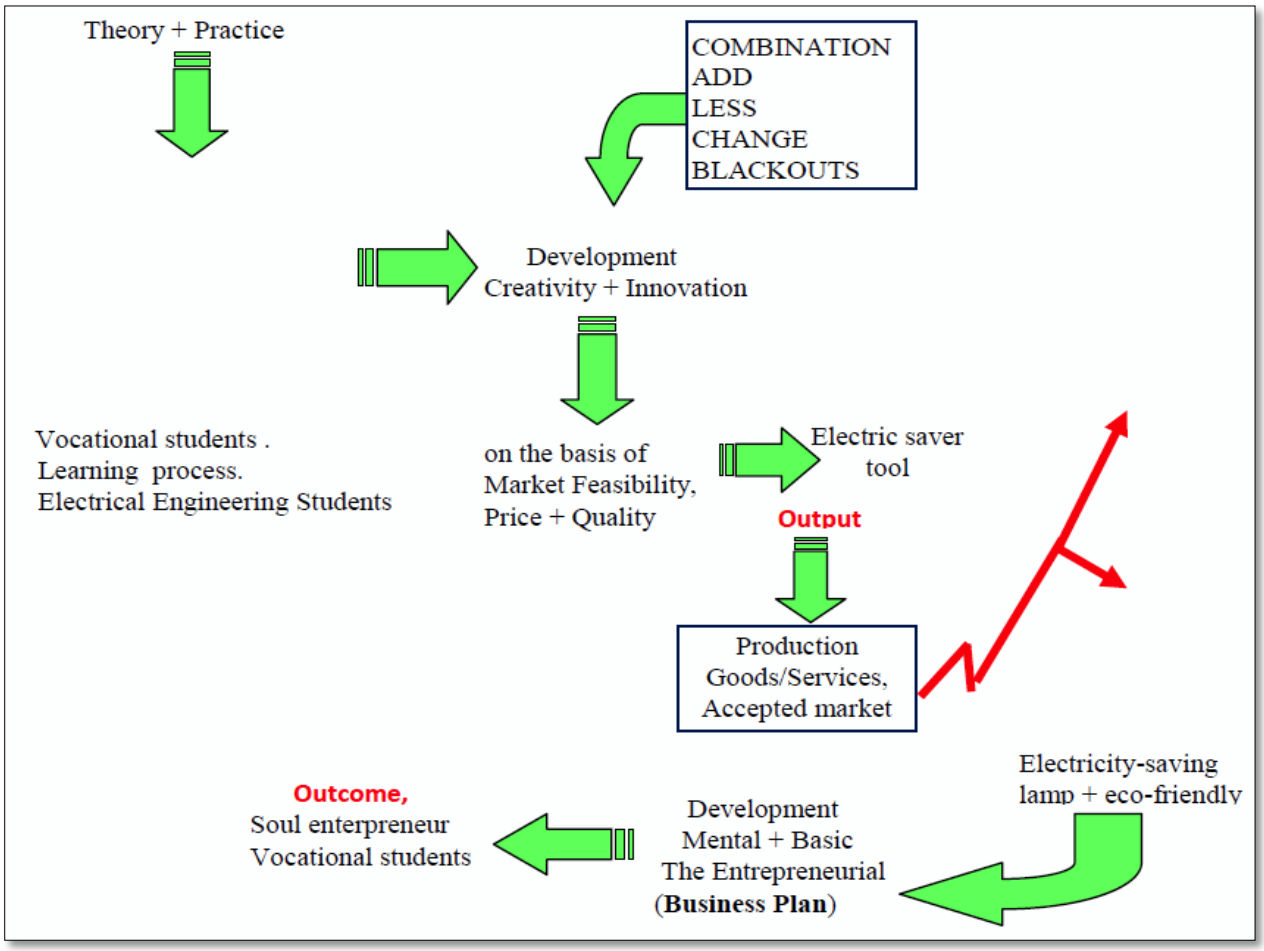

Figure 5. Production-based learning model

CONCLUSION

Diploma (D3) program that had 6 semesters or terms for 3 years period. Product media are created from structured exercises that referred to students competency levels needed and also initiated from external inquiries through collaboration with industrial parties, in Production Based Education (PBE) system. With industrial product handling setup in organization, the QCD necessity for the customers is embedded in such system. Special tools is the suitable product media for this kind of education, supported with necessary theory session in operation/ production, basic of project management and technical matter during the learning process where students experiencing the comprehensive tools project. With this model of education, students learn not only processing skills but also introduced to other related production and project management issues such as material and component preparation, operation planning, scheduling, managing and control the project, etc.

Production-based learning process during lecture or workshop provides increased quality and meaningfulness of learning. The experience of learning that student's associate with work practice or the work piece exactly in accordance with the standards and specifications of the field. The learning process gives impact on the increased interest in entrepreneurship among students. In addition, learning activities provide increased insight into the impact on cognitive, psychomotor skills and attitude in their work, thus this model is deemed right to be used in the effort for improving the entrepreneurial interests among students.

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AUTHORS

Mr. Sushil Kumar Swar
BE(Civil COEP Pune) , ME (Const. Tech. Mgt. Thapar)
Selection Gr. Lecturer in Civil Engineering
Government Polytechnic Nashik
Maharashtra, India. E mail: swarsushil@rediffmail.com
(Worked for 6months in NBCC and 30 years teaching experience)

Mr. Sanjay Prabhakar Dikshit
BE(Civil SGSITS Indore) , M.Tech (Edu) NITTTR Bhopal
Selection Gr. Lecturer in Civil Engineering
(I/c Curriculum Development Cell)
Government Polytechnic Nashik
Maharashtra, India. E mail: sp_dikshit@rediffmail.com
(1 year industrial experience and 28years teaching experience)

Mr. Ravindra Nanasaheb Vaidya
BE(Civil Amravati) , MA (Sanskrit),
Head of Civil Engineering Dept.(I Shift)
Government Polytechnic Nashik
Maharashtra, India. E mail: rnvaidya@rediffmail.com
(Worked for 7 years MSBTE Mumbai and 27 years teaching experience)

Mr. Sanjay Rangrao Deshmukh
BE Civil Pune, ME[Geo.Tech. Engg.]
Head of Civil Engineering Dept.(II Shift)
Government Polytechnic Nashik
Maharashtra, India.
Email: sdeshmukhgpa@gmail.com
(Worked for 1 year in MSEB and 27 years teaching experience)