Approval: 13th Senate Meeting

IIT Mandi
Proposal for a New Course

Course Number	:EE 508P
Course Name	: Practicum on Electric Drives
Credits	: **0-0-3-2**
Prerequisites	: EE201 and EE201P – Electromechanics or Equivalent, EE309 and EE309P - Power Electronics or Equivalent
Intended for	: Final year BTech Electrical Engineering (EE), M.Tech in Power Electronics and Drives (PED)
Distribution	: Core for 1 year M.Tech. (PED), Elective for other PG and BTechFinal year EE
Semester	: Odd (Aug-Dec)

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1. **Preamble:**Practicum on Electric Drives is a laboratory course which is designed to accompany the ongoing course EE508 (Fundamentals of Electric Drives), both of which are core (mandatory) courses for M.Tech (PED) students in their first semester. These courses together establish a strong foundation for Electric Drive basics along with a laboratory hands-on component which enables the students to appreciate real-life implementation constraints. This course requires the knowledge of basics of electric machines and power electronics, and bridges the gap between these pre-requisite courses and more advanced courses in electric drives.

2. **Course Modules with Quantitative lecture hours:**This is a laboratory course with 3-hour sessions per week. Following is the list of course modules and experiments.

   - Introduction to Drives **(6 hours)**
     1. Calculation of moment of inertia of drive + load system
     2. Verification of Fundamental Drive Equation
     3. Study of types of loads and their torque-speed characteristics
   - DC Drives **(12 hours)**
     1. Characteristics of different types of DC motors (series, shunt, separately excited)
     2. Speed control (acceleration, braking) of DC motors (Rectifier fed, chopper fed)
     3. Dynamic control of DC drives (closed loop controller design, simulation and validation)
     4. Regenerative braking in closed loop DC drives
     5. Closed loop controller design and digital implementation of separately excited DC motor drive
     6. Introduction to field weakening mode operation and effect on dynamic performance
   - Induction Motor Drives **(15 hours)**
     1. No-load/blocked rotor test on induction motor

2. Plotting speed-torque characteristics of an induction motor
3. Stator voltage control of induction motor (fed with VSI)
4. V/f control of induction motor (fed with VSI)
5. Slip speed control of induction motor (fed with VSI)
6. Rotor resistance control of slip-ring induction motor
7. Study of three-phase self-exited induction generator (SEIG)

- Synchronous Motor Drives **(6 hours)**
  1. Driving the motor from a variable voltage and frequency supply
  2. Study of V-curves

- Speed control of Special machines **(3 hours)**
  BLDC, PMSM, etc.

3. **Textbook:**

Lab. experimental manuals will be provided.

4. **References:**

1. W. Leonhard, Control of Electrical Drives, Springer-Verlag Berlin Heidelberg, 2001.
2. Mohan N., Undeland T. M. and Robbins W. P., Power Electronics - Converters, Applications and Design, 3rd Edition, Wiley India, 2008.
3. Bose B. K., Power Electronics and Variable Frequency Drives - Technology and Applications, IEEE Press, Standard Publisher Distributors, 2001.
4. Rashid M., Power Electronics - Circuits, Devices and Applications, 3rd Edition, Pearson Education.
5. Krause, P. C., Wasynczuk, O., Sudhoff, S. D., Analysis of Electric Machinery and Drive Systems, New York, Wiley-Interscience.

6. **Similarity Content Declaration with Existing Courses:** About 10-15% with EE201P
7. **Justification for new course proposal if cumulative similarity content is > 30%:** N/A