

**Electrical Engineering, VII Semester**

**EE-7001 High Voltage Engineering**

**Unit-I**

**Introduction:-** Introduction to HV technology, advantages of transmitting electrical power at high voltages, need for generating high voltages in laboratory. Important applications of high voltage.

**Unit-II**

**Breakdown phenomena:-** Classification of HV insulating media, Properties of important HV insulating media. Gaseous dielectrics: Ionizations: primary and secondary ionization processes. Criteria for gaseous insulation breakdown based on Townsend's theory, Limitations of Townsend's theory. Streamer's theory breakdown in non uniform fields. Corona discharges. Paschen's law and its significance. Time lags of Breakdown. Breakdown in solid dielectrics: Intrinsic Breakdown, avalanche breakdown, thermal breakdown, and electro mechanic breakdown. Breakdown of liquids dielectric dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown (bubble's theory), electro convection breakdown.

**Unit-III**

**Generation of HV AC DC and Impulse Voltage and current:-** HV AC-HV transformer; Need for cascade connection and working of transformers units connected in cascade, Series resonant circuit-principle of operation and advantages. Tesla coil. HV DC- voltage doubler circuit, cock croft- Walton type high voltage DC set, Introduction to standard lightning and switching impulse voltages. Analysis of single stage impulse generator-expression for Output impulse voltage, Multistage impulse generator Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement. Triggering gap and oscillograph time sweep circuits. Generation of switching impulse voltage. Generation of high impulse current.

**Unit-IV**

**Measurement of high voltages:-** Electrostatic voltmeter-principle, construction and limitation. Generating voltmeter- Principle, construction. Series resistance micro ammeter for HV DC measurements. Standard sphere gap measurements of HV AC, HV DC, and impulse voltages; Factors affecting the measurements. Potential dividers-resistance dividers capacitance dividers mixed RC potential dividers. Surge current measurement.

**Unit-V**

**High voltage tests on electrical apparatus:-** Definitions of technologies, tests on isolators, circuit breakers, cables insulators and transformers.

**Reference books:**

1. E. Kuffel and W.S. Zaengl, "High voltage engineering fundamentals", 2nd edition, Elsevier, press, 2005.
2. M.S.Naidu and Kamaraju, "High Voltage Engineering", 3rd edition, THM, 2007.
3. L. L. Alston, "High Voltage technology", BSB Publication, 2007..
4. Rakosh Das Begamudre, Extra High voltage AC transmission engineering, Wiley Eastern limited, 1987.
5. Transmission and distribution reference book-Westing House.C.L.Wadhwa, High voltage engineering, New Age International Private limited, 1995.

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

**Electrical Engineering, VII Semester**

**EE-7002 Electric Drives**

## **Unit - I**

**Control of D.C. motors by converters:-** Introduction to Thyristor Controlled Drives, single phase semi and fully controlled converters and three semi and fully controlled converters connected to d.c. separately excited and d.c. series motors-continuous current operation, Output voltage and current waveforms, Speed and Torque expression, Speed-Torque Characteristics, Problems on converter fed d.c. motors.

## **Unit - II**

**Four quadrant operation of D.C. Drives.:** Introduction to Four quadrant operation, Motoring operations, Electric braking, Plugging, dynamic and regenerative braking operations. Four quadrant operation of D.C. motor by Dual converters-Closed loop operation of DC motor (Block diagram only)  
**Control of D.C. Motors by Choppers:-**Single quadrant, Two-quadrant and four quadrant chopper fed d.c. separately excited and series excited motors, Continuous current operation, Output voltage and current waveforms-Speed torques expressions-Speed torque characteristics, Problems on Chopper fed d.c. motors, Closed loop operation (Block diagram only)

## **Unit-III**

**Control of Induction Motors on stator side:-**Control of Induction Motor by AC Voltage controllers- Waveforms, Speed torque characteristics, Variable frequency control of induction motor by Voltage Source, Current Source inverters and cycloconverters, PWM control Comparison of VSI & CSI operations, Speed- torque Characteristics, Numerical problems on induction motor drives, Closed loop operation of induction motor drives. (Block diagram only)

## **Unit-IV**

**Control of Induction Motors from rotor side:-**Static rotor resistance control, Slip power recovery static Scherbius Drive, Static Kramer Drive, Their performance and speed torque characteristics advantages- application-problems.

## **Unit-V**

**Control of Synchronous Motors:-** Separate control & Self control of synchronous motors, Operation of self controlled synchronous motors by VSI, CSI and Cycloconverters. Load commutated CSI fed Synchronous motor, Operation, Waveform, Speed torque Characteristics, Application, Advantage, Numerical problems, Closed loop operation of synchronous motors drives. (Block diagram only)

### **References:**

1. G.K. Dubey "Fundamentals of Electrical Drives"-. Narosa Publications
2. Gopal K. Dubey "Power semiconductor Controlled Drives"- PHI
3. S.B. Dewan, G.R. Slemon, A. Straughen "Power semiconductor Controlled Drives
4. B.K. Bose "Power Electronic control of AC Drives". PHI Learning.
5. Ned Mohan Electrical Drive Wiley India
6. V. Subramanyam "Thyristor control of Electric Drive" Tata Mc Graw Hill Pub
7. N.K. De , P.K. Sen "Electric Drives" PHI
8. S.K. Pillai, "A first course of Electrical Drive" New age International.
9. S.K. Pillai. "Analysis of Thyristor Power conditioned Motors" University Press (India)Ltd.
10. Longman P.V. Rao, "Power semiconductor Drives", BS Publications.
11. S.Shiva Nagaraju power semiconductor drive PHI learning

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

## **Electrical Engineering, VII Semester**

### **EE-7003 Computer Application to Power System**

#### **Unit -I**

Models of power system components, network model using graph theory, formation of Z bus, transmission line models, regulating transformer, line loadability, capability curves of alternator.

#### **Unit -II**

Control of load bus voltage using reactive power control variable, SVC & SVS, Regulated shunt compensation, series and shunt compensation, Uniform series and shunt compensation and effect on loadability of transmission lines.

#### **Unit -III**

Sensitivity analysis- General sensitivity relations, generation shift distribution factors, line outage distribution factors, compensated shift factors, sensitivity associated with voltage-VAR, sensitivities relating load bus voltage changes in terms of PV bus voltage changes, sensitivity relating changes in reactive power generation for changes in PV Bus Voltage.

#### **Unit -IV**

Power system security - Security functions, Security level, contingency analysis, security control, economic dispatch using LP formulation, pre-contingency and post- contingency, corrective rescheduling.

#### **Unit -V**

Voltage stability - Difference between voltage and angle stability, PV Curve for voltage stability assessment, proximity and mechanism, modal analysis using reduced Jacobian, participation factor, effect of series and shunt compensation on voltage stability , effect of load models.

#### **References:**

- Power Generation, Operation and Control by A.J. wood and B.F. Wollenberg John Wiley & Sons Inc. 1984.
- Computer methods in power systems analysis - by stage G.W. and E.L. Abiad A.H. Mc Graw Hill. Computer Techniques in Power Systems Analysis- Pai M.A. Tata Mc Graw Hill.
- Computer Modeling of Electrical Power Systems, Arrillaga J. Arnord C.P Harker B.J. John Wiley & Son
- Computer Aided Power Systems Analysis Kusic G.L.- 2nd Edition, CRC Press
- Modern Power Systems Analysis Nagrath I.J. and Kothari D.P. Tata Mc Graw Hill.
- Power System Analysis Grainger J.J. & Stevnson W.D. Mc Graw Hill.
- Power System Stability and control -P Kundur ,IEEE Press 1994.
- Advance Power Systems Analysis and Dynamics Singh L.P. JohnWiley.
- Chakrabarti –Power System Analysis operation & Control – PHI Learning

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

## **Electrical Engineering, VII Semester**

### **EE-7004 Elective – III (1) Advance Power Electronics**

#### **UNIT- 1**

Introduction to various power electronics supplies. Performance parameters for power electronics supplies and their measurement. Device selection, Control circuits. Switch mode power supplies, Square wave switching, Resonant mode operation of Power supplies , Ferroresonant, Linears and the switchers.

#### **UNIT- 2**

DC to DC Converters: Analysis and design of buck, boost, buck-boost and cuk converters, two quadrant and full bridge converters. Isolated converters i.e., flyback, forward and bridge topology. Design of d.c. inductor. Concept of integrated magnetics, converter control, averaged model, state-space model.

#### **UNIT- 3**

DC to Controlled AC: Controlled inversion, three phase full bridge inverters. 180° mode and 120° mode operation, harmonic analysis, PWM control of VSI, current mode control of PWM VSI, space vector modulation, three phase current sourced PWM CSI,

#### **UNIT- 4**

AC Choppers: Modeling and analysis of AC choppers, harmonics control using symmetrical and asymmetrical waveform pattern,

#### **UNIT- 5**

Soft switching DC to DC converters, zero current switching topologies, zero voltage switching topologies, generalized switching cell, ZCT and ZVT DC converters,

#### **Text Books:**

1. "Power Electronics Circuits", Issa Batarseh, John Wiley & Sons Inc., 2004.
2. "Power Electronics: ", L.Umanad, Wiley India.
3. "Power Electronics: Converters, Applications, and Design", Ned Mohan, John Wiley & Sons Inc., 2001.
4. "Power Electronics: Devices and Circuits", Jagannathan, PHI Learning 2012

#### **Reference Books:**

1. "Power Electronic Systems Theory and Design", Jai P Agrawal, Pearson Education Asia, 2001.
2. "Switching Power Supply Design", A I Pressman, McGraw Hill Publication, 1991.
3. "Handbook of Power Electronics", M H Rashid

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

## Electrical Engineering, VII Semester

### EE-7004 Elective – III (2) Computer aided Design of Electrical Machines

**Introduction:** Design problem-Mathematical programming methods, computer aided design-Mathematical formulation of the problem. Programming techniques (LP & NLP only), Methods of solution, Unconstrained optimization problems, constrained optimization problems.

**Optimal design of DC machine:-**Design of armature, Windings and field systems, Selection of variables for optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design.

**Optimal design of power transformer:-**Design of magnetic circuit, Design of windings, Selection of variables for optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design.

**Optimal design for 3-phase alternator:-**Design of stator, windings, Design of Field systems for salient pole and non-salient pole machines, Selection of variables for optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design.

**Optimal design of 3-phase induction motor:-**Design of stator, Windings Design of squirrel cage rotor, Design of slip ring rotor, Selection of variables for optimal design, Formulation of design equations, Objective functions Constraint functions, Algorithms for optimal design.

#### References:

- 1.Design and Testing of Electrical Machines,MV Deshpandey PHI Learning
- 2.Computer- Aided Design of Electrical Equipment- by Dr. M. Ramamoorthy-Affiliated East-West press Pvt. Ltd. New Delhi.
- 3.Electrical Machine Design- by A.K. Sawhney, Dhanpat Rai & Sons.
- 4.Principles of Electrical Machine Design with Computer Programmes by- S.K. Sen, Oxford & IBH Publishing Co.
- 5.Performance and Design of A.C. Machines-M.G. Say, Affiliated East West Press Pvt. Ltd., New Delhi.

**Electrical Engineering, VII Semester**

**EE-7004 Elective – III (3) Renewable & Non-Conventional Energy Systems**

***Unit - I***

**Renewable Energy Systems**

Energy Sources, Comparison of Conventional and non-conventional, renewable and non-renewable sources. Statistics of world resources and data on different sources globally and in Indian context. Significance of renewable sources and their exploitation. Energy planning, Energy efficiency and management.

***Unit – II***

**Wind Energy System**

Wind Energy, Wind Mills, Grid connected systems. System configuration, working principles, limitations. Effects of wind speed and grid conditions. Grid independent systems - wind-battery, wind-diesel, wind-hydro biomass etc. wind operated pumps, controller for energy balance. Small Hydro System Grid connected system, system configuration, working principles, limitations. Effect of hydro potential and grid condition. Synchronous versus Induction Generator for stand alone systems. Use of electronic load controllers and self excited induction generators. Wave Energy System: System configuration: grid connected and hybrid systems.

***Unit - III***

**Solar Radiation**

Extraterrestrial solar radiation, terrestrial solar radiation, Solar thermal conversion, **Solar Photo tonic System**

Solar cell, Solar cell materials, efficiency, Characteristics of PV panels under varying insulation. PV operated lighting and water pumps, characteristics of motors and pumps connected to PV panels.

**Biomass Energy System:** System configuration, Biomass engine driven generators, feeding loads in stand-alone or hybrid modes, Biomass energy and their characteristics.

***Unit – IV***

**Energy from oceans**

Ocean temperature difference, Principles of OTEC, plant operations,

**Geothermal Energy**

Electric Energy from gaseous cells, Magneto-hydro generated energy, Non hazardous energy from nuclear wastes, Possibilities of other modern non-conventional energy sources.

***Unit - V***

**Electric Energy Conservation**

Energy efficient motors and other equipment. Energy saving in Power Electronic controlled drives. Electricity saving in pumps, air-conditioning, power plants, process industries, illumination etc. Methods of Energy Audit.

**Measurements systems;** efficiency measurements. energy regulation, typical case studies, various measuring devices analog and digital, use of thyristers.

**References:**

John Twidell & Toney Weir, Renewable Energy Resources, E & F N Spon.

El-Wakil, Power Plant Technology, McGraw Hill.

Rai G D, Non-conventional Energy Resources, Khanna.

F Howard E. Jordan, "Energy-Efficient Electric Motor & their Application-II", Plenum Press, New York, USA.

Anna Mani, "Wind Energy Resource Survey in India-III", Allied Publishers Ltd., New Delhi,

S.P. Sukhatme: Solar Energy, TMH-4e,

Dr. A. Ramachandran, Prof B.V Sreekantan & M F.C. Kohli etc, "TERI Energy Data Directory & Year book 1994-95", Teri Tata Energy Research Institute, New Delhi,

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

## **Electrical Engineering, VII Semester**

### **EE-7004 Elective – III (4) SCADA Systems & Applications**

#### **Unit I**

**Introduction to SCADA and PLC:** SCADA: Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions. PLC: Block diagram, programming languages, Ladder diagram, Functional Block diagram, Applications, Interfacing of PLC with SCADA.

#### **Unit II**

**SCADA system components:** Schemes, Remote Terminal Unit, Intelligent Electronic Devices, Communication Network, SCADA server.

#### **Unit III**

**SCADA Architecture-**Various SCADA Architectures, advantages and disadvantages of each system, single unified standard architecture IEC 61850 SCADA / HMI Systems.

#### **Unit IV**

**SCADA Communication-**Various industrial communication technologies- wired and wireless methods and fiber optics, open standard communication protocols.

#### **Unit V**

**Operation and control of interconnected power system-**Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, state estimation.

#### **Unit**

**VI:** SCADA applications Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water. Case studies, implementation, simulation exercises.

#### **Reference Books:**

1. Stuart A Boyer: SCADA supervisory control and data acquisition.
2. Gordan Clark, Deem Reynders, Practical Modem SCADA Protocols.
3. **Sunil S. Rao, Switchgear and Protections, Khanna Publication.**



**UNIT -1**

**Power System Fundamentals**

Regulation and Deregulation, condition for deregulation, problems with regulation, risk management, congestion management, ATC, screening curve.

**Unit-2**

**Competitions in Power Market**

What is competition, efficiency of perfect competition, marginal cost in power market, role of marginal cost, working with marginal cost, results of marginal cost.

**UNIT-3 Market Power And Structure**

Define market power, price quality outcomes, three stages of market power, using price quality outcomes to show power, monopoly in power auction, market power on demand side.

**UNIT- 4**

**Restructure**

Fundamental restructure system, transmission pricing, restructure models, OASIS, structure of OASIS, transfer capability of OASIS.

**UNIT -5**

**Designing And Testing Market Rules**

Design for competitive prices, testing of market design, designing to reduce market power.

**REFERENCES:**

- 1- Power system economics-designing for electricity-steven soft. (IEEE press & WILEY-INTERSCIENCE).
- 2- Electric Power Systems weedy,cory, wily india 2<sup>nd</sup> edition

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

## **Electrical Engineering, VII Semester**

### **EE-7005 Elective – IV (2) EHVAC/DC Transmission**

#### **Unit-I**

Constitution of EHV a.c. and d.c. links, Kind of d.c. links, Limitations and Advantages of a.c. and d.c. transmission, Principal application of a.c. and d.c. transmission, Trends in EHV a.c. and d.c. transmission, Power handling capacity. Converter analysis garetz circuit, Firing angle control, Overlapping.

#### **Unit-II**

FACTS devices, basic types of controller, series controller, static synchronous series compensator(SSSC), thyristor-controlled series capacitor(TCSC), thyristor controlled series reactor(TCSR), shunt controller (STATCOM), static VAR compensator(SVC), series-series controller, combined series-shunt controller, unified power flow controller(UPFC), thyristor controlled phase shifting transformer(TCPST).

#### **Unit-III**

Components of EHV d.c. system, converter circuits, rectifier and inverter valves, Reactive power requirements, harmonics generation, Adverse effects, Classification, Remedial measures to suppress, filters, Ground return. Converter faults & protection harmonics misoperation, Commutation failure, Multiterminal D.C. lines.

#### **Unit-IV**

Control of EHV d.c. system desired features of control, control characteristics, Constant current control, Constant extinction angle control. Ignition Angle control. Parallel operation of HVAC & DC system. Problems & advantages.

#### **Unit-V**

Travelling waves on transmission systems, Their shape, Attenuation and distortion, effect of junction and termination on propagation of traveling waves. Over voltages in transmission system. Lightning, switching and temporary over voltages: Control of lighting and switching over voltages

#### **Reference:**

1. S. Rao,- "EHV AC & DC Transmission" Khanna pub.
2. Kimbark,- "HVDC Transmission" john willy & sons pub.
3. Arrillaga,- "HVDC Transmission" 2nd Edition ,IEE london pub.
4. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
5. T.K. Nagsarkar,M.S. Sukhiza, -"Power System Analysis", Oxford University
6. Narain.G. Hingorani, I. Gyugyi- "Understanding of FACTS concept and technology", john willy & sons pub.
7. P.Kundur- "H.V.D.C. Transmission" McGraw Hill Pub.

**UNIT I**

Basic Issues Involved in Bulk Power Transmission, Review of basics of power transmission networks-control of power flow in AC transmission line- Analysis of uncompensated AC Transmission line- Passive reactive power compensation, Principle of Transmission system compensation, Need for FACTS controllers- types of FACTS controllers and Benefits

**UNIT II - STATIC VAR COMPENSATOR (SVC) and Purpose**

Voltage control by SVC – Advantages of slope in dynamic characteristics- Influence of SVC on system voltage, Design of SVC voltage regulator, Modeling of SVC for power flow and stability studies, Applications- Enhancement of transient stability, Steady state power transfer, Enhancement of Power system damping, Prevention of voltage instability

**UNIT III - THYRISTOR AND GTO THYRISTOR CONTROLLED SERIES CAPACITORS (TCSC and GCSC)**

Concepts of Controlled Series Compensation –Analysis of TCSC-GCSC , Different modes of operation, Modeling of TCSC and GCSC for load flow studies- modeling TCSC and GCSC for stability studies- Applications of TCSC and GCSC, SSR mitigation.

**UNIT IV - VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS**

Static synchronous compensator(STATCOM)- Static synchronous series compensator(SSSC)- Operation of STATCOM and SSSC-Power flow control with STATCOM and SSSC- Modeling of STATCOM and SSSC for power flow studies –operation of Unified and Interline power flow controllers(UPFC and IPFC).

**UNIT V - CONTROLLERS AND THEIR CO-ORDINATION**

FACTS Controller interactions – SVC–SVC interaction - co-ordination of multiple controllers using linear control techniques – Quantitative treatment of control coordination.

**References-**

1. Mohan Mathur, R., Rajiv. K. Varma, Thyristor – Based FACTS Controllers for Electrical Transmission Systems, IEEE press and John Wiley & Sons, Inc, 2002.
2. K.R.Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International (P) Ltd., Publishers, New Delhi, Reprint, 2008.

3. A.T.John, Flexible AC Transmission System, Institution of Electrical and Electronic Engineers (IEEE), 1999.

4. NarainG.Hingorani, Laszio. Gyugyl, Understanding FACTS Concepts and Technology of Flexible AC Transmission System, Standard Publishers, Delhi, 2001.

5. V. K.Sood, HVDC and FACTS controllers- Applications of Static Converters in Power System, Kluwer Academic Publishers, 2004.

**UNIT-I**

Review of Linear Control System: Modelling through differential equations and difference equations, State space method of description and its solution, Discretization of continuous-time state space model, Laplace and z-domain analyses of control systems, Controllability, Observability & Stability, Bode & Nyquist analysis, Root Loci, Effect of load disturbance upon control actions.

**UNIT-II**

Development of feedback control laws through state space technique, Modal control, Pole placement problem.

**UNIT-III**

Variable Structure Control and its applications. Examples on variable structure control.

**UNIT-IV**

Control of nonlinear dynamics: Lyapunov based control function, Phase plane technique, Lyapunov Stability analysis.

**UNIT-V**

Optimal Control: Calculus of variation, Euler-Lagrange equations, Boundary conditions, Transversality condition, Bolza problem, Pontryagin's maximum principle.

**Reference:**

1. Automatic Control System – B.C. Kuo, PHI, New York, 1975.
2. Modern Control Engineering: K. Ogata, PHI. New Delhi, 1992.
3. Digital Control Systems – B. C. Kuo, Oxford Pub.
4. Discrete-Time Control Systems – K. Ogata. PHI. New Delhi
5. Advanced Control Systems N Sarkar PHI Learning
6. Control System Engineering S NISE Wiley India

The Major Project Work provides students an opportunity to do something on their own and under the supervision of a guide. Each student shall work on an approved project, which may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work involves sufficient work so that students get acquainted with different aspects of manufacture, design or analysis. The students also have to keep in mind that in final semester they would be required to implement whatever has been planned in the Major Project in this semester. It is possible that a work, which involves greater efforts and time may be taken up at this stage and finally completed in final semester, but partial completion report should be submitted in this semester and also evaluated by an external examiner. At the end of semester, all students are required to submit a synopsis.

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

**Electrical Engineering, VII Semester**

**EE-7007 Industrial Training**

## SCHEME OF STUDIES

Duration: 2 weeks after the VI semester in the summer break, Assessment in VII semester.

## SCHEME OF EXAMINATION

For the assessment of industrial training undertaken by the students, following components are considered with their weightage.

(a) Term work

In Industry

Marks allotted

1. Attendance and General Discipline
2. Daily diary Maintenance
3. Initiative and participative attitude during training
4. Assessment of training by Industrial Supervisor/s

05  
05  
05  
05

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TOTAL

20

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(b) Practical/Oral Examination (Viva-Voce)

In Institution

Marks allotted

1. Training Report
2. Seminar and cross questioning (defense)

10  
20

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TOTAL

30

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Marks of various components in industry should be awarded to the students, in consultations with the Training and Placement Officer/Faculty of Institute, Who must establish contact with the supervisor/Authorities of the organisation where, students have taking training to award the marks for term work and I/c of training from Industry. During training students will prepare a first draft of training report in consultation with section in-charge. After training they will prepare final draft with the help of T.P.O./Faculty of the institute. Then they will present a seminar on their training and they will face viva-voce on training in the institute.

## 1.1 OBJECTIVE OF INDUSTRIAL TRAINING

**The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World of Work and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an engineering problem and possibly an industry guide for their Major Project in final semester.**

Industrial training of the students is essential to bridge the wide gap between the classroom and industrial environment. This will enrich their practical learning and they will be better equipped to integrate the practical experiences with the classroom learning process.

## **1.2 LEARNING THROUGH INDUSTRIAL TRAINING**

During industrial training students must observe following to enrich their learning:

- Industrial environment and work culture.
- Organisational structure and inter personal communication.
- Machines/ equipment/ instruments - their working and specifications.
- Product development procedures and phases.
- Project planning, monitoring and control.
- Quality control and assurance.
- Maintenance system.
- Costing system.
- Stores and purchase systems.
- Layout of Computer/ EDP/MIS centres.
- Roles and responsibilities of different categories of personnel.
- Customer services.
- Problems related to various areas of Work etc.

Faculty and TPO are supposed to plan industrial training in such a manner that students get exposure on most of the above arena in the field (world of work).

Students are supposed to acquire the knowledge on above by -

1. Observation,
2. Interaction with officials at the workplace
3. Study of Literature at the workplace (e.g. User Manual, standards, maintenance schedules, etc.)
4. "Hand's on" experience
5. Undertaking / assisting project work.
6. Solving problems at the work place.
7. Presenting a seminar.
8. Participating in-group meeting/ discussion.
9. Gathering primary and secondary data/ information through various sources, Storage, retrieval and analysis of the gathered data.
10. Assisting officials and managers in their working.
11. Undertaking a short action research work.
12. Consulting current technical journals and periodicals in the library.
13. Discussions with peers.

## **1.3 GUIDANCE TO THE FACULTY/TPO FOR PLANNING AND IMPLEMENTING THE INDUSTRIAL TRAINING**

The industrial training programme, which is spread to 2 weeks' duration, has to be designed in consultation with the authorities of the work place, keeping in view the need of the contents.

Following are some of the salient points:

- Spelling out the objectives of the industrial training in behavioral terms and same is informed in advance to the 1) students, 2) authorities of the work place and 3) supervising faculty members.
- Discussing and preparing students for the training for which meetings with the students has to be planned.
- Meeting with industrial personnel and orienting them regarding the objective of the training and the expectations of the programme.
- Correspondence with the authorities of the work place.
- Orientation classes for students on how to make the training most beneficial - monitoring daily diary, writing weekly reports, how to interact with various categories of industrial personnel, how to behave and undertake responsibilities, how to gather information from the workplace, ethics etc.
- Guiding students to make individual plans (week wise/ day wise) to undertake industrial training



- Developing a system of maintaining training records, by teachers for every batch of students for convenient retrieval.
- Inviting industrial personnel to deliver lectures on some aspects of training.

#### 1.4 ACTION PLAN FOR PLANNING STAGES AT THE INSTITUTION LEVEL

S.No.	Activity	Commencing	Week	Finishing week	Remarks
1.	Meeting with Principal				
2.	Meeting with Colleagues				
3.	Correspondence with work place (Industries concerned)				
4.	Meeting with authorities of work place				
5.	Orientation of students for industrial training				
6.	Scrutinizing individual training plan of students				
7.	Commencement of industrial training				
8.	First monitoring of industrial training				
9.	Second monitoring of industrial training				
10.	Finalization of Training report				
11.	Evaluation of performance at Industry level				
12.	Evaluation of industrial programme in the institution.				

#### 1.5 INDUSTRIAL TRAINING

##### DAILY DIARY

Name of the

Trainee:.....College:.....

Industry/Work place:.....Week

No.:.....

Department/Section:.....Date:.....

.....

Dates

Brief of observations made, work done, problem/project  
undertaken, discussion held,literature-consulted etc.