

M.E. (Full Time)

Prospectus No. 151713

संत गाडगे बाबा अमरावती विद्यापीठ  
SANT GADGE BABA AMRAVATI UNIVERSITY

अभ्यासक्रमिका  
(FACULTY OF ENGINEERING & TECHNOLOGY)  
PROSPECTUS

Prescribed for  
Two Year Post Graduate Degree Course  
Master of Engineering  
(Full Time)  
Credit Grade System  
I & II<sup>nd</sup> Year Examinations 2013 - 2014 & Onwards

BRANCHES

- 1) M.E. Civil (Construction Engineering & Management)
- 2) M.E. Electrical (Electronics & Power)



2014  
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Price Rs. ....../-

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Registrar,  
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Amravati - 444 602

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**SANT GADGE BABA AMRAVATI UNIVERSITY**

**SPECIAL NOTE FOR INFORMATION OF THE STUDENTS**

- (1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.
- (2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	:	Enrolment of Students.
Ordinance No. 2	:	Admission of Students
Ordinance No. 4	:	National cadet corps
Ordinance No. 6	:	Examinations in General (relevant extracts)
Ordinance No. 18/2001	:	An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001.
Ordinance No. 9	:	Conduct of Examinations (relevant extracts)
Ordinance No. 10	:	Providing for Exemptions and Compartments
Ordinance No. 19	:	Admission of Candidates to Degrees.

- |                         |   |  |
|-------------------------|---|--|
| Ordinance No. 109       | : | Recording of a change of name of a University student in the records of the University.  |
| Ordinance No. 6 of 2008 | : | For improvement of Division/Grade.   |
| Ordinance No.19/2001    | : | An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001. |

**Dineshkumar Joshi**  
Registrar  
Sant Gadge Baba Amravati University

**PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM**

The pattern of question paper as per unit system will be broadly based on the following pattern.

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.
- (5) Each short answer type question shall contain 4 to 8 short sub question with no internal choice.

**SANT GADGE BABA AMRAVATI UNIVERSITY**

**DIRECTION**

No. 23/2013

Dated :- 22/10/2013

**Subject :-** Examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full Time) / तंत्रशास्त्र पारंगत (Master of Technology) (Full Time) (Semester Pattern - Credit Grade System)

Whereas, Direction No. 31/2010 in respect of the examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full Time) / तंत्रशास्त्र पारंगत Master of Technology) (Full Time) (Semester Pattern — Credit Grade System) is in existence,

AND

Whereas, the Master of Engineering Civil (Construction Engineering & Management) (Full Time) and Master of Engineering Electrical (Electronics & Power) (Full Time) courses has been started at the affiliated colleges of this University,

AND

Whereas, the Board of Studies in Civil Engineering (including Construction Technology) in its meeting held on 23.08.2013 and the Board of Studies in Electrical Engineering (including E.P.S.) in its meeting held on 17.08.2013 resolved to recommend the Schemes of teaching & examinations, Eligibility Criteria and draft syllabi of M.E.Civil (Construction Engineering & Management) and M.E. Electrical (Electronics & Power) (Full Time) Courses for its implementation from the current session 2013-2014 and onwards,

AND

Whereas, Hon'ble Vice Chancellor has accepted the Schemes of teaching & examinations, Eligibility Criteria and draft syllabi of M.E.Civil (Construction Engineering & Management) course under Section 14(7) of the Maharashtra Universities Act, 1994 on behalf of the Faculty of Engineering & Technology and Academic Council, which is approved by the Academic Council in its meeting held on 31/08/2013,

AND

Whereas, the Academic Council in its meeting held on 31/08/2013 vide Item No.83 has approved the Schemes of teaching & examinations, Eligibility Criteria and draft syllabi of M.E. Electrical (Electronics & Power) (Full Time) Course,

AND

Whereas, the matter of admission of the students at the examination is required to be regulated by an Ordinance,

AND

Whereas, the Schemes of Examinations and Syllabi alongwith Eligibility Criteria for admission to the courses are to be implemented from the current academic session 2013-2014,

AND

Whereas, admissions to the First Year of Master of Engineering (Full Time) courses are to be made in the academic session 2013-2014,

AND

Whereas, the process of making an ordinance and the regulation is likely to take some time,

AND

Whereas, the Schemes of Examinations for Semester I & II of M.E.(Full Time) Courses are to be made available to the concerned from the session 2013-2014,

Now, therefore, I, Dr.Mohan K.Khedkar. Vice Chancellor of Sant Gadge Baba Amravati University, Amravati in exercise of powers conferred upon me under the sub-section (8) of Section 14 of the Maharashtra Universities Act, 1994, do hereby direct as under :-

- 1) This Direction shall be called “Examinations leading to the Degree of अभियांत्रिकी पारंगत Master of Engineering) (Full Time)/ तंत्रशास्त्र पारंगत (Master of Technology) (Full Time) (Semester Pattern - - - Credit Grade System) Direction, 2013”.
- 2) This Direction shall come into force with effect from the session:
  - i) 2013-2014 for Semester I & II and
  - ii) 2014-2015 for Semester III & IV
- 3) The Eligibility Criteria for admission to the Degree of Master of Engineering (Full Time) courses shall have passed the degree examination in Bachelor of Engineering in the branches mentioned under column No.3 of the following table against the respective courses mentioned under column No.2 :-

**TABLE**

<b>Sr.No.</b>	<b>M.E.Branches</b>	<b>Entry level Qualification B.E. of any statutory University</b>
<b>1</b>	<b>2</b>	<b>3</b>
01.	M.E. Civil (Construction Engg. & Management)	Civil/Construction Engg. Similarly Diploma holders in Civil Engg. who have completed A.M.I.E. through the Institution of Engineers (I), Kolkata.
02.	M.E. Electrical (Electronics & Power)	Electrical Engineering, Electrical (Electronics & Power), Electrical & Electronics Engg., Electronics Engg., Industrial Electronics Engg., Electronics & Telecommunication Engg., Instrumentation, Electrical Power System, Biomedical Engg., Telecommunications Engineering.

- 4) The Schemes of teaching and examination for M.E.Civil (Construction Engineering & Management) (Full Time) (C.G.S.) and M.E. Electrical (Electronics & Power) (Full Time) shall be as per the Appendices – A,B, C, D & E appended with this Direction .
- 5) Other related provisions of the Direction No. 31 of 2010 shall be applicable for the above mentioned Courses.

Date : 20/10/2013

Sd/-  
(Mohan K. Khedkar)  
Vice-Chancellor



Second Semester																		
			TEACHING SCHEME					EXAMINATION SCHEME										
			Hours / Week					Theory							Practical			
Sr. No.	Subject Code	Subject	Lecture	Tutorial	Practical	Total Hours	CREDITS		Duration of Paper (Hr.)	Max Marks Theory Paper	Max Marks College Assessment	Total	Min. Passing Marks		Internal Marks	External Marks	Total	Min Passing Marks
													Subject	Total				
01	<b>2CM01</b>	Construction Equipment & Machinery Management	4	0	0	4	4		3	80	20	100	40	50	--	--	--	--
02	<b>2CM02</b>	Construction Finance & Accounting Management	4	0	0	4	4		3	80	20	100	40	50	--	--	--	--
03	<b>2CM03</b>	Construction Contract, Laws & Regulations	4	0	0	4	4		3	80	20	100	40	50	--	--	--	--
04	<b>2CM04</b>	Construction Quality Control & Management	4	0	0	4	4		3	80	20	100	40	50	--	--	--	--
05	<b>2CM05</b>	Elective-II	4	0	0	4	4		3	80	20	100	40	50	--	--	--	--
06	<b>2CM06</b>	Construction Finance & Accounting Management -Lab	0	0	2	2	1		--	--	--	--	--	--	25	25	50	25
07	<b>2CM07</b>	Seminar-II	0	1	0	1	1		--	--	--	--	--	--	50	--	50	25
		Total	20	1	2	23	22		--	--	--	500	--	--			100	
																Total	<b>600</b>	
Elective-II		(ii) Construction Safety Management (ii) Construction Project Management Information System (iii) Energy Conservation Techniques in Building Construction (iv) Building Services In Construction Engineering																

## Appendix - C

Third Semester			TEACHING SCHEME						EXAMINATION SCHEME									
Sr. No.	Subject Code	Subject	Hours / Week			Total Hours	CREDITS		Theory					Practical				
			Lecture	Tutorial	Practical				Duration of Paper (Hr.)	Max Marks Theory Paper	Max Marks College Assessment	Total	Min. Passing Marks		Internal Marks	External Marks	Total	Min Passing Marks
01	3CM01	Seminar and Dissertation	--	--	6	6	15	--	--	--	--	--	--	100				
		Semester Total	--	--	6	6	15									100	50	
Fourth Semester																		
01	4CM01	Seminar and Dissertation	--	--	12	12	30		--	--	--	--	--	--	100	200	300	150
		Semester Total	--	--	12	12	30										300	150
		GRAND TOTAL															1600	

**Semester III**

**Seminar:** Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance. Dissertation: Title of the dissertation work to be submitted to the University on or before 15<sup>th</sup> Sept. (for regular examination) and 15<sup>th</sup> of February (for supplementary exam).

**Semester IV**

**Seminar:** Seminar to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

**Thesis Report:**

Thesis of dissertation work must be submitted to the University on or before 30<sup>th</sup> April (for regular exam.) and 30<sup>th</sup> November (for supplementary exam). Thesis of Dissertation work be submitted with late fee to the University up to 31<sup>st</sup> May (for regular exam.) and 31<sup>st</sup> December (for supplementary exam.) The late fee shall charge as in case of Examination form.

**Note:**

1. Student should fill the examination form in the beginning of III semester jointly for III & IV semester.
2. Single mark sheet for III & IV semester together will be given to the student.

**Eligibility Criteria :** Candidates who have acquired BE/B.Tech or equivalent degree in Civil Engineering/Construction Engineering. Similarly Diploma holders in Civil Engg. who have completed A.M.I.E. through the Institution of Engineers (I), Kolkata by securing not less than 50% marks in aggregate are eligible.





Appendix - E

Third Semester												
Sr. No.	Subject Code	Subject	Lecture	Tutorial	Practical	Total	CREDITS		INTERNAL MARKS	TOTAL	MIM. PASSING MARKS	
01	3ECPME1	SEMINAR AND DISSERTATION	–	–	6	6	15		100	100	50	
		TOTAL	–	–	6	6	15			100		
										TOTAL		100

Fourth Semester												
Sr. No.	Subject Code	Subject	Lecture	Tutorial	Practical	Total	CREDITS		EXTERNAL MARKS	INTERNAL MARKS	TOTAL	MIM. PASSING MARKS
01	4ECPME1	SEMINAR AND DISSERTATION	–	–	12	12	30		200	100	300	150
		TOTAL	–	–	12	12	30			300		
											TOTAL	300
GRAND TOTAL 1600												

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.).

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam. ) and 30th November ( for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of III semester jointly for III & IV semester.

2. Single marksheet for III & IV semester together will be given to the student.

Eligibility: Candidates who have acquired BE/B.Tech or equivalent degree in Electrical Engineering, Electrical (Electronics & Power), Electricals & Electronics Engineering, Electronics Engineering, Industrial Electronics Engineering, Electronics & TeleCommunication, Instrumentation, Electrical Power Systems, Biomedical Engineering, Telecommunication Engineering by securing not less than 50% marks in aggregate are eligible.

**SYLLABUS PRESCRIBED FOR  
M.E. CIVIL ENGINEERING (CONSTRUCTION  
ENGINEERING & MANAGEMENT)**

**SEMESTER -I**

**1CM01 CONSTRUCTION PROJECTS PLANNING &  
MANAGEMENT (CPPM)**

- Unit-I-** Introduction, Importance of construction and industry, Construction project management and its relevance, Participants & stakeholders. Project Organization, Company, organizations, Structure, Management Levels, Ethical conducts, Traits of Project Manager, Important Traits of Project Coordinator.
- Unit-II-** Construction Economics, Decision making, Time value, Cash flow diagram, Interest tables, Evaluating Alternatives. Methods and Types of Estimation, structuring, Project costs, cases in preparation of estimates. Cost and Value Management.
- Unit-III-** Construction Project Planning, project plans, Work breakdown and planning, Handling project, phase-out and transfers, Details schedule and charts, Master production scheduling. Planning techniques, Bar charts, Network diagram, PERT, CPM, Ladder network, precedence network, Line of balance, Network techniques advantages.
- Unit-IV-** Resource leveling, Resource allocation, Importance of project scheduling, other schedule derived from project schedules, Network crashing and cost-time trade-off. Project Monitoring and Control systems, Project Updating, Project control, schedule / Time / Progress control, cost control, Control of schedule, cost and technical performance, Earned value method.
- Unit-V-** Cost and Bidding Strategy, Contractor's estimation and bidding process, Bidding models, determination of optimum markup level, bidding and estimation practice in Indian construction industry  
Construction Project Claims, Disputes and Project Closure, Sources, Management and Guideline for Claims, Causes, avoidance, resolution, mechanism of Dispute, Correspondence, Project Closure.

- Unit-VI-** Computer Application in Scheduling, Resource Leveling, Monitoring and Reporting, Introduction to project management software, Function of project management software, Introduction to Illustration of MS Project and Primavera. Construction Project Success, Project performance measurement, criteria for project performance evolution, project performance attributes, effect of other elements on project performance, Theory of 3CS and Iron Triangle.

**TEXT BOOK:**

1. Kumar Neeraj Jha, "Construction Project Management- Theory and Practice", Pearson Education, New Delhi, 17

**REFERENCE BOOKS:**

1. K. K. Chitkara, "Construction Project Management- Planning, schedule and controlling", second edition", Tata McGraw Hill Education Pvt. Ltd, New Delhi.
2. John M. Nicholas and Herman Steven, "Project management for engineers, business and technology", fourth edition, Routledge Publication, New York.
3. Prasanna Chandra, "Projects Planning, analysis, selection, financing, implementation and review", 7th edition, McGraw Hill Education India Pvt. Ltd., New Delhi.
4. Harold Kerzner, "Project Management system approach to planning, scheduling and controlling, second edition", CBS publishers & distributors Pvt Ltd, New Delhi.

**1CM02 CONSTRUCTION MATERIALS & MATERIAL  
MANAGEMENT (CMMM)**

- Unit-I-** Introduction of Material Management, Integrated Materials management, Classification, codification of materials, Specification in Material Management, Standardization and variety reduction.
- Unit-II-** Material planning, Budgeting and material planning, Store Management, Store and store keeping, Storage equipments, Material Handling, Principles of materials handling, Material wastage standards, Use of operation research in material Planning.
- Unit-III-** Inventory Management Models, Inventory control, Selective inventory control, ABC/VED/GOLF/FSN, EOQ- Economic Order Quantity concept

**Unit-IV -** Purchasing cycle, principles of purchasing, nature of purchasing process and vendor rating, Quality control in material management, Evolution of quality concept and application, Theory of sampling inspection, Control charts and In-process monitoring of Quality, Six Sigma Quality concept.

**Unit-V -** Make or buy decisions, Buyer- seller relationship, Negotiations, Disposal and surplus, obsolete and scrap management, Performance appraisal of Materials Department, Legal Aspects of Purchasing.

**Unit-VI -** Computers in Material Management, Governmental Buying, Foreign purchase, Material Audit, Human aspect of Material management, Communication and Material Management, Reporting of Materials management activities.

**TEXT BOOKS :**

1. A.K.Chitale, R.C.Gupta, “Materials management Text and Cases”, PHI learning pvt ltd. New Delhi, 2009
2. P. Gopalkrishnan, “Purchasing and Material Management”, Tata McGraw Hill Education pvt. ltd, New Delhi.

**REFERENCE BOOKS:**

1. L.C. Jhamb, “Material and Logistics Management”, Everest Publishing House, Pune-30
2. P. Gopalkrishnan, “Handbook of Material management”, PHI learning pvt ltd. New Delhi, 2009
3. K. K. Chitkara, “Construction Project Management, Planning, schedule and controlling”, second edition”, Tata McGraw Hill Education pvt. Ltd, New Delhi.
4. Martin K. Starr and Millar, “Inventory Management”, Prentice Hall of India Pvt. Ltd.
5. P. Gopalkrishnan and Sundaresan, “Materials Management an Intergrated Approach, Prentice Hall of India.

**1CM03 QUANTITATIVE METHODS IN CONSTRUCTION ENGINEERING (QMCE)**

**Unit-I -** Operation Research Models, solving OR models, Queing and simulation models, Modeling with Linear programming, Graphical LP solution, selected LP applications, Computer solution with solver and AMPL, Simplex method and Sensitivity analysis.

**Unit-II -** Transportation Model and its variants, Transportation Algorithm, Assignment model, Transshipment Model, Network Models, CPM and PERT.

Deterministic inventory Models, Static Economic Order quantity (EOQ) Model, dynamic EOQ Model, Decision Analysis, Decision under Risk and uncertainty, Game Theory.

**Unit-III -** Simulation Modeling, Type, Elements, Generation, Mechanics, method and Language.

Inventory Management systems, SS System, Fixed order quantity system, Periodic review system, one period model, selective approach.

Queuing Theory, structure, operating characteristics, queuing models, Replacement Theory.

**Unit-IV -** Theory of Cost and Investment analysis –Cost output relations, Empirical cost function estimates, Time value of money, Annuities, Capital budgeting, incorporating risk, Learning curves, Break even analysis, Investment under certainty, Concept of Risk and Uncertainty, Investment decisions under risk and uncertainty

**Unit-V -** Nature and scope of Managerial Economics, Objectives of business firms, Concept used in Business decisions, Opportunity cost and decision rule, Marginal principle, Contribution analysis, Equi-marginal principle, time perspective, Business Cycles and Stabilization, changing international Business Environment, Social Responsibility of Private Business.

**Unit-VI -** Market structure and Pricing decisions ,Pure monopoly, monopoly power, decisions under monopolistic competition & Oligopoly, Pricing Strategies and Practices ,Cost plus pricing, Multiple product pricing, pricing in life cycle, Established product pricing, transfer pricing, competitive bidding of price, pear load pricing.

**TEXT BOOKS:**

1. N. D. Vohra, “Quantitative techniques in Management”, 3rd edition, Tata McGraw Hill pvt ltd, New Delhi.
2. Hamdy A. Taha, “Operation Research ,An Introduction”, 8th edition, Pearson Education, New Delhi ,17

**REFERENCE BOOKS:**

1. D.N. Dwivedi, “Managerial Economics”, 7th edition, Vikas publishing house Pvt. Ltd, New Delhi.
2. Premkumar Gupta and Dr. D.S. Hira, “Operation Research”, Revised edition 2011, S. Chand and company Ltd, New Delhi.

3. J. K. Sharma, "Quantitative Techniques for managerial decisions", Mac Millan India Ltd, New Delhi
4. O. P. Khanna, "Industrial Engineering and Management", Dhanpat Rai Publication Pvt. Ltd. New Delhi.

#### **1CM04 ADVANCED CONSTRUCTION TECHNIQUES(ACT)**

- Unit-I-** Fundamental of Construction Technology, Productivity and Mechanized construction, Construction Document and records, Quality and Safety, Code and regulations.  
Preparatory work and Implementation, site layout, Construction method and materials, deployment of construction equipment, prefabrication in construction, false / temporary work. Transportation and handling, Road, Railway, waterway and airways transportation, hauling and handling.
- Unit-II-** Earthwork, Classification of soils, mechanized excavation, ground water control, trenchless technology, grading, dredging.
- Unit-III-** Excavation by Blasting ,rock excavation, basic mechanics of breaking, blasting theory, drillability of rocks, kinds of drilling, selection of equipment, explosives, blasting patterns and firing sequence, smooth blasting, environmental effect of blasting.  
Piling ,Basic concept, Classification of piles, pile driving and construction methods, load tests and quality control.
- Unit-IV-** Concrete and Concreting ,Properties, composition & quality of cement, sand, aggregate, water and steel, Various types of special concrete and their use, Inspection of concrete, Mechanization of concreting, laboratory testing at site, non destructive testing of hardened concrete.
- Unit-V -** Fabrication and Erection work ,Welding technology, supervision, quality and approval, Handling and transportation, Erection of fabricated steel structure and Precast concrete structure, Erection of bridges, grouting of joints, anti corrosive painting.  
Cladding and Walls, Masonry types, material and bonding, special types, enabling work for cladding and its approval.
- Unit-VI-** Roof and Roofing, cast in situ reinforced concrete roof, Thermal insulation and waterproofing over roofs, shell roofs.  
Finishing work, plastering, facing, glazing, flooring, painting, External work, Road and drainage, accommodation of services and impact.

Mechanized construction, Plant and tools for earthwork, transportation and handling, concrete mixers, pumps, scaffoldings.

#### **TEXT BOOK :**

1. S.S.Sarkar, Subhajit Saraswati, "Construction Technology", Oxford university press, New Delhi

#### **REFERENCE BOOKS:**

1. R. Chudley, Roger Greeno, "Advanced construction technology", Pearson Prentice Hall, 2006, U.K.
2. R. Chudley, Roger Greeno, "Construction technology", Pearson Prentice Hall, U.K.
3. V. K. Jain, "Hand Book of Design and Installation of Services in High Rise Building Complexes"
4. E. I. Reddy, "Advanced Materials and Techniques for Reinforced Concrete Structure (Hand Book)"
5. Patrick Powers. J., "Construction Dewatering: New Methods and Applications", John Wiley and Sons, 1992.

#### **1CM05 Elective-I (i) BUILDING REPAIR & MAINTENANCE MANAGEMENT (BRMM)**

- Unit-I-** Introduction of Building Repair and Maintenance, Historical background, Economic consideration, Principle , terminology & criteria of Repair , Restoration ,Retrofitting , strengthening and rehabilitation. Principles of Maintenance management and Quality Assurance, Maintenance work force, Information and communication system, Property inspection report, Maintenance budget estimates, specifications, health and safety requirements, quality maintenance, corrective and preventive maintenance, maintenance manual, Agencies causing deterioration ,Mechanism and effect.
- Unit-II-** Investigation of defects in building, Systematic approach, scope, objective, diagnosis of defects, Material tests, Non destructive tests, Diagnosis of problems, Actual loads and environmental effects, Retrospective analysis, confirmation of diagnosis, Maintenance Problems and Root causes, Causes of defect, Investigation of dampness.
- Unit-III-** Common Materials and Techniques for Repair and Maintenance ,Durability, compatibility, types of repair materials, characteristics

and properties, selection of material, commercially available repair materials.

Preventive Maintenance and Special Precautions, considerations, sweeping / washing, Joint maintenance, Dusting floors, Termite control, damp proofing of roof and wet areas, Water supply and sanitary systems, Special precautions of repair of building.

**Unit-IV -** Structural Audit, Common techniques of Building Repairs, Surface preparation, Common repair technique, Common methods of crack repair, Repair of Existing DPC, repairing in wet areas, waterproofing of flat roofs, modern repair material and techniques, protective coatings. Protection, Repair and Maintenance of RCC elements, Prevention of corrosion and its repair, concrete placement techniques, repair of surface defects.

**Unit-V -** Repair and Maintenance of foundations, Basement and DPC, stabilizing foundation, underpinning, repair of raft slab foundations, basement and DPC against rising dampness. Repair of Finishes, Repair of wall finishes, decorative coatings, internal wall finishes. Defects in door, windows, joinery and fixtures, Cleaning and Repair of wall paneling, false ceiling, aluminum elements, glass and floors.

**Unit-VI -** Repair of building joints, Sealing of joints, safety precautions in joint sealants, Repair of Water supply and sanitary systems, maintenance of pipes, taps, traps, WC cisterns, cleaning clogged drains and pipes, maintenance survey, repair and maintenance of water tanks. Common Strengthening Techniques, Additional interior reinforcement, Exterior reinforcing, Post tensioning, jackets, brackets and collars, supplementary members, underpinning.

#### **TEXT BOOK:**

1. P. S. Gahlot, Sanjay Sharma, "Building Repair and Maintenance Management", CBS Publishers & Distributors Pvt. Ltd., New Delhi.

#### **REFERENCE BOOKS:**

1. Causes, Prevention and Remedies of Cracks in Building", SP25, Bureau of Indian Standards.
2. V. K. Jain, "Hand Book of Design and Installation of Services in High Rise Building Complexes"
3. S. Champion, "Failure and Repair of Buildings", John Wiley

4. S. M. Jhonson, "Deterioration Maintenance and Repair of Buildings", McGraw Hill.
5. Sushil Kumar, "Building Construction", Standard Book Publishing, New Delhi

#### **1CM05 Elective-I (ii) HUMAN RESOURCE MANAGEMENT IN CONSTRUCTION INDUSTRY (HRMC)**

**Unit-I -** Definition, Role and challenges of Personnel Management, Acquisition of Human Resources, Human Resource planning, Assessing requirements, Matching demand and supply, Job Analysis methods and Purpose of job analysis, Recruiting sources, Factors affecting recruiting, Possible constraints.

**Unit-II -** Selection Process, cost of selection, Discrete selection process, Comprehensive approach, Elements in successive predictors, Selection Devices, Application forms, Employment tests, interviews, realistic job previews, Background investigation, Physical examination.

**Unit-III -** Development of human Resources, Training needs, Employee Training and Learning, Training methods, Management development and methods, evaluating training effectiveness, Job design, Work scheduling and Motivation, Design, scheduling and expectancy theory, job enrichment, job rotation, work modules, flexible time, new trends in work scheduling.

**Unit-IV -** Performance Appraisal, definition, Appraisal process, Methods, factors affecting appraisal, Rewarding, Types of reward, Qualities of effective reward, criteria for reward distribution.

**Unit-V -** Compensation Administration, government influences, Job evaluation and pay structure, Incentives, executive compensation.

Discipline problems, Administering discipline, Disciplinary actions, Employment-at-will Doctrine, Disciplining special employee groups, Quality of work life, Quality circles, Discovery of Conflicts of Interest, Processing of Grievances, Conflict Resolution. Communication and Counseling, Channels and structure, Communication filters, Johari's Window, communication process and counseling.

**Unit-VI -** Downsizing, Effects, employee morale and attitude, Downsizing and workforce quality, Process considerations, Layoffs, Seniority and Age effect, documenting and rationalizing layoff decisions.

Outsourcing, Transactional, social and administrative considerations, Outsourcing and legal liabilities, Outsourcing and downsizing, Separation, Turnover, Retirement, Out Placement, discharge.

**TEXT BOOK:**

1. David A. Decenzo, Stephen P. Robbins, "Personnel and Human resource management", Prentice hall of India pvt. Ltd, New Delhi

**REFERENCE BOOKS:**

1. Abhijeet Gandage, Prof. Dr. M. S. Ranadive, "Performance Appraisal Systems for Construction Engineers and Managers" March 2011 LAP Lambert Academic Publishing, U. K.
2. Edwin B Flippo, "Personnel Management" Tata McGraw Hill India pvt ltd, New Delhi
3. Adrian Thronhill, Phil Lewis, Mike Milimore, Mark Saunders, "Managing changes, A Human resource strategic Approach", Pearcian education India pvt. Ltd. New Delhi.
4. Monappa A, "Personnel Management", Tata McGraw Hill, New Delhi 1997.
5. Rao T, "HRD in the New Economic Environment", Tata McGraw Hill.
6. William J Brums Jr. "Performance Measurement, Evaluation and Incentive", Tata McGraw Hill.

**1CM05 Elective-I (iii) CONSTRUCTION ENGINEERING FOR DISASTER MANAGEMENT (CEDM)**

- Unit I-** Overview of Disaster Management – Distinguishing between an emergency and a disaster situation. Natural Disasters - Classifications and nature of impacts, Vulnerability factors and Risk analysis of Natural disasters and Hazard estimations.
- Unit II-** Information needs of Disaster management, Global Disaster Alert and Coordination System, Solving Disaster Management Challenges Using Remote Sensing - Case studies, Tsunami Information System, GIS for Emergency Management.
- Unit III-** Disaster Management Cycle – Phase I: Mitigation, and strategies; hazard identification and vulnerability analysis. Disaster Mitigation and Infrastructure, impact of disasters on development programmes, vulnerabilities caused by development, developing a draft country level disaster and development policy

- Unit IV-** Disaster Management Cycle – Phase II: Preparedness, Disaster Risk Reduction (DRR), Emergency Operation Plan (EOP), Mainstreaming Child Protection and Gender in Emergency Planning, Assessment, Disaster Management Cycle – Phases III and IV: Response and recovery, Response aims, Response Activities, Modern and traditional responses to disasters, Disaster Recovery, and Plan, Disasters as opportunities for development initiatives

- Unit V-** Disaster Community-Community-based Initiatives in Disaster management, need for Community-Based Approach, categories of involved organizations: Government, Non-government organizations (NGOs), Regional And International Organizations, Panchayaths, Community Workers, National And Local Disaster Managers, Policy Makers, Grass-Roots Workers, Methods Of Dissemination Of Information, Community-Based Action Plan, Advantages/Disadvantages Of The Community-Based Approach

- Unit VI-** Disaster Planning-Disaster Response Personnel and duties, Community Mitigation Goals, Pre- Disaster Mitigation Plan, Personnel Training, Volunteer Assistance, School-based Programmes, Hazardous Materials, Ways of storing and safely handling hazardous materials, Coping with Exposure to Hazardous Materials

**TEXTBOOKS:**

1. Babar, Md.: Environmental Changes and Natural Disasters, New India Publishing Agency, 2007.
2. D.B.N. Murthy - Disaster Management - Deep and Deep Publication, 2008.

**REFERENCE BOOKS:**

1. Ayaz,. Disaster Management: Through the New Millennium. , Anmol Publications. (2009)
2. Dave, P. K.. Emergency Medical Services and Disaster Management: A Holistic Approach.
3. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., 2009
4. Narayan, B. ,Disaster Management, New Delhi: A.P.H. Publishing Corporation ,2009
5. Kumar, N.. Disaster Management. New Delhi: Alfa Publications. , 2009
6. Ghosh, G. K., Disaster Management. New Delhi: A.P.H Publishing Corporation. ,2008

**1CM05 Elective-I (iv) ADVANCED TOPICS IN COMPUTER INTEGRATED CONSTRUCTION (ATCIC)**

- Unit I-** Structural- Structural system, Systems for enclosing buildings, Functional aesthetic system, Materials selection and Specification. Environmental-Qualities of enclosure necessary to maintain a specified level of interior environmental quality-Weather Resistance-Thermal infiltration-Acoustic control-Transmission reduction-Air quality-Illumination-Relevant Systems integration with structural systems
- Unit II-** Mechanical & Communication systems -Elevators, Escalators, Conveyors, Security Systems In High Rise Building Complexes, Public Buildings, Parking Lots And Complex Structures Like Hospitals, Public Transport Terminals . Design parameters for Determining the Loads & Requirement, Operation And Maintenance Of These Services.
- Unit III-** Maintenance-Component Longevity in terms of operation performance and resistance to deleterious forces-Planning systems for least maintenance-Feasibility for replacement of damaged components -equal life elemental design- Maintenance free exposed and finished surfaces.
- Unit IV -** Intelligent Buildings & Building Management System (BMS)- Concept-Purpose-Control Technologies- Automation Of All The Services And Equipment -Building Management Systems (BMS) -Commercial, Industrial, Institutional And Domestic Buildings-Energy Management Systems And Building controls.
- Unit V-** Technology Trends and their context for Facility Managers, The drivers, trends and implications for Facility Managers, Advances in technology and the context of different technology types, Technology and innovative workplace, Applications and Implementation Issues, Enabling technologies – review of current tools,
- Unit VI-** Embedded building technologies – the FM perspective, Organisational evaluation and technology implementation issues, Technology Strategy Development, Reviewing the organisation and the facility, Developing a Technology Strategy for embedded, enabling and enhancing technologies, Presenting a Technology-based business case.

**TEXT BOOKS:**

1. Brandon, P., and Betts, M., Integrated Construction Information, Chapman Hall / E & FN Spon, 1995.
2. Cornick, Tim, Computer-integrated Building Design, E & FN Spon, London, 1995.

**REFERENCE BOOKS:**

1. S. Don Swenson., HVAC Heating, Ventilating, and Air Conditioning, 2004
2. William T.Mayer, “ Energy Economics and Build Design “, McGraw Hill Book Co., 1983.
3. Peter R.Smith and Warren G.Jullian, “ Building services “, Applied Science Publishers Ltd.,London.1976
4. A.J.Elder and Martiz Vinden Barg, “ Handbook of Buildings and Enclosure “, Mc Graw-Hill Book Co., 1983.
5. David Fletcher, Intelligent Buildings: Design Management and Operation, The Institution of Structural Engineers,2004
6. Derek Clements-Croome, Intelligent Buildings: Design, Management And Operation, Thomas Telford, 2004

**1CM06 CONSTRUCTION MATERIAL & MATERIAL MANAGEMENT - LAB**

Student will perform following experiments in the laboratories and write a Journal / test report as a part of Laboratory work. Minimum eight experiments to be performed.

- a) Laboratory tests on aggregates and bitumen as a flexible pavement material, any two experiment
  - b) Laboratory Tests related with determination of various soil properties related with construction, any two experiment
  - c) Laboratory Tests related with determination of destructive / non-destructive material properties, any two experiment
  - d) Laboratory Tests related with determination of potability of water and chemical contents in water required for construction, any two experiment
- A visit to relevant construction industry / organization / site is suggested.

**1CM07 SEMINAR–I**

The Seminar shall be based on the recent trends in the field of Construction Engineering and Management preferably related to the subjects 1CM01 to 1CM05. It should be surveyed from the technical literature published in International / National journals. A report should be prepared following the guidelines of IEI Journal paper format, submitted and followed by the presentation

**SEMESTER - II**  
**2CM01 CONSTRUCTION EQUIPMENT & MACHINERY MANAGEMENT (CEMM)**

- Unit-I-** Construction Equipment, History, utilization, Economics, Importance, Record, Rent paid for the use of money, Cost of capital, Investment alternatives, ownership cost, operation cost, Cost of bidding, replacement decisions, rent and lease considerations.
- Unit-II-** Earthwork, graphical presentation, quantities, mass diagram, pricing earthwork operations, Soil and rock properties, compaction, Stabilization of soil and rock, types of compacting equipment, roller production estimating, dynamic compaction, soil stabilization.  
 Drilling rock and earth, bits, drilling method, estimating drilling production, drilling soil, trench-less technology, safety, Blasting, explosives, primers and boosters, Initiating systems, rock fragmentation, blast design, power factor, trench rock, breakage control techniques, vibrations, blasting safety.
- Unit-III-** Pile and Pile driving equipments ,Pile types and classification, Driving piles, Resistance of pile to penetration, site investigation and test pile program, pile hammer, supporting and positioning piles during driving, jetting pile, spudding and preaugering, hammer selection, pile driving safety.  
 Power requirement, useable power, performance charts. Dozers, performance characteristics, Pushing material, Blades, production estimating, safety, Land clearing, rippers, Rippability of rock, thickness and strength of rock layer, ripper attachment, ripper production estimates, Scrappers, scraper production estimating, scraper safety.
- Unit-IV-** Excavators , accidents, Front Shovel, production, height of cut & angle of swing, effect on shovel production, Hoes ,bucket rating for hydraulic hoes, selecting hoes, calculating hoes production, Loaders ,loader buckets and attachments, Operation specification, loader production rates, loader safety.  
 Trenching machine, selecting equipment for excavating trenches, trenching machine production, trench safety, backhoe loaders, Holland loaders, Vac excavators, Truck, rigid frame rear cump truck, articulated rear dump truck, tractors with bottom dump trailers, capacities of truck and hauling equipment, calculating truck productivity, Truck performance calculations, truck safety.

- Unit-V-** Cranes ,type, mobile cranes, crawler cranes, telescopic boom truck mounted crane, lattice boom truck mounted cranes, rough terrain cranes, all terrain cranes, modified cranes for heavy lifting, crane booms, lifting capacity of crane, Rated loads for crane, working ranges of crane, Tower crane classification, operation, tower crane selection, Rigging basics, slings, crane safety, crane accidents.
- Unit-VI-** Asphalt equipment, flexible pavement, asphalt concrete, asphalt plant, batch plant, drum mix plant, dust collectors, asphalt storage and heating, reclaiming and recycling. Paving equipment, sweepers / brooms, Haul truck asphalt destructors, asphalt pavers, compaction equipment.  
 Concrete mixtures ,Proportioning, batching concrete material, mixing concrete techniques, ready mixed concrete, central mixed concrete, Placing concrete, buckets, manual or motor propelled buggies, chutes and drop pipes, belt conveyors, concrete pumps, consolidating concrete, finishing and curing concrete, slipform paving, roller compacted concrete, shotcreting, placing concrete in cold and hot weather, Safety in concreting operations.

**TEXT BOOK:**

1. Peurifoy, Schexnayder, Shapira,, “Construction Planning, Equipment and Methods” Tata McGraw Hill Edition, New Delhi.

**REFERENCE BOOKS:**

1. Mahesh Varma,”Construction Equipment and its Planning and Application”, Metropolitan Book Co. (P) Ltd., New Delhi, India.
2. Singh Jagnam, “Heavy Construction Planning, Equipment and Methods”, Oxford and IBH Publishing Co. Ltd, New Delhi, Second Edition.
3. Frank Harris and Ronal Caffer,” Management of Construction Equipment”, Macmillan Publication.
4. Kumar Neeraj Jha, “Construction Project Management ,Theory and Practice”, Pearson Education, New Delhi ,17
5. K. K. Chitkara, “Construction Project Management, Planning, schedule and controlling”, second edition”, Tata McGraw Hill Education pvt. Ltd, New Delhi.



**2CM02 CONSTRUCTION FINANCE &  
ACCOUNTING MANAGEMENT (CFAM)**

- Unit-I-** Project cost and value management, Collection of cost related information, Cost codes, Cost statement, Application of value management.  
Planning Construction Costs, Overview of methods of estimating project cost, classification of construction cost, planning resources, unit rate, Planning work-package, Standard Production Cost, Planning Earned value of Work package, Project time phase, baseline development.
- Unit-II-** Construction Budget, Earned value budget, Operating expenses budget, Cost inflation, Escalation and contingencies, Budgetary Forecast, Project master budget, Importance of project budget. Cost control systems, Preliminaries, Direct cost control, Contribution and Indirect cost control, Traditional budgeted cost control, Performance control using Earned value management, Earned value management system.
- Unit-III-** Construction Accounts Management, Principles of accounting, Accounting process, Construction contract revenue recognition, Construction contract status report, Limitations of accounting, Balance Sheet, Profit and loss account, Working capital, Ratio analysis, Fund Flow statement.
- Unit-IV-** Financial Estimates and Projections ,Cost of project, Means of finance, Cost of production, working capital requirement and its financing, Profitability projections, Project cash flow statement, Project balance sheet, Multiyear projections.
- Unit-V-** Financing of Projects ,Capital structure, Menu of financing, Equity Capital, Preference capital, debentures or bond, method of offering, Term loans, Working capital advances, Raising venture capital, Project financing structures, Financial closure, Credit risk rating Financing Infrastructure Projects ,Typical project configuration, Financing structure and corporate governance, Recommendations on infrastructure financing.
- Unit-VI-** Venture Capital and Private equity ,Public Private Partnership, VC Investors and VC Investment, VC Investment Appraisal Process and Management, VC and PE comparison, Indian VC & PE industry, Current concerns and Regulations of VC Industry in India, VC fund.

**TEXT BOOK:**

1. Projects ,Planning, analysis, selection, financing, implementation and review by Prasanna Chandra, 7th edition, McGraw Hill Education India Pvt. Ltd., New Delhi.

**REFERENCE BOOKS:**

1. D. Lal, "Construction Management and PWD Accounts", S. K. Kataria & Sons, Darya Ganj, New Delhi-2
2. Financial Policy and Management Accounting, 7th edition, by Bhabatosh Banerjee, Prentice hall of India, New Delhi.
3. R. Narayanaswamy, "Finaicial Accounting, A managerial Perspective", PHI learning pvt. Ltd,
4. Kirti S. Sanghvi, "A Practical Guide to Construction and Real Estate – Accounting, Taxation and FEMA Regulations"
5. Kumar Neeraj Jha, "Construction Project Management ,Theory and Practice", Pearson Education, New Delhi ,17
6. K. K. Chitkara, "Construction Project Management, Planning, schedule and controlling", second edition", Tata McGraw Hill Education Pvt. Ltd, New Delhi.

**2CM03 CONSTRUCTION CONTRACT, LAWS  
& REGULATIONS (CCLR)**

- Unit-I-** PWD Procedure for Works ,Classification of work, Original, repair works, annual repair, Quadrennial repair, Special repair work, contract, Tender, Tender notice, Earnest Money, Security deposit, Arranging contract, Power of accepting tender.  
Lump-sum Contract, Lump-sum and schedule contract, schedule contract, conditions of contract, Contract document, Labor contract, cost plus percentage contract, labor engaged through contractor, Penalty, compensation for delay in completion, Liquidated damages, Extension of time, Termination of contract, dabitable agency.
- Unit-II-** Contracting in Civil Engineering, requirement, profession, Client interaction, requisites of contractor, various fields in civil engineering contract work, Types of Contract, Anomalies, Form of contracts, Written and Oral agreements, competitive bidding, lump- sum and item rate contract, cost plus contract, subcontracts.
- Unit-III-** Construction Management Functions, Contract negotiations, liaison with clients, financing the work, Accounting, Work

supervision, Monitoring record, labor relations. Bidding, strategy in bidding, considerations in costing a Bid.

Possible Contractual Problems, Development of Disputes, creation of claims, seeking settlement of contractual problems, Equitable Adjustment, Selection of Consultant, Request for Proposal, Terms of reference, Various formulae, Pre-qualifying Contractor, Evaluation criteria.

**Unit-IV -** Contract Management System, Procurement and contract procedures, Bidding process, Tender document, preparation of tender, Submission of tender, tender opening and evaluation, Various Check list for Bidding related work, Contract Monitoring Process, Indicators for monitoring, Monthly project report.

**Unit-V -** Construction Contract ,Price ,Escalation and Estimating, Application of Price adjustment formula, Simple and compact method, world bank method, detailed method, Items of non concern with price, FIDIC conditions of contract. Arbitration, Comparison of Actions and Laws Agreements, subject matter, Violations, Appointment of Arbitrators, Conditions of Arbitrations, Powers and duties of Arbitrator, Rules of Evidence, Enforcement of Award costs.

**Unit-VI -** Legal requirements for planning , Property Law, Agency Law, Local Government Laws for Approval Statutory Regulations (Development control rules for Local body for A Class, B Class and C Class) Town planning Act. Labor Regulation , Social Security, Welfare Legislation, Laws relating to wages, Bonus and Industrial Disputes, Labor Administration, Insurance and Safety Regulations, Workmen's Compensation Act, Other Labor laws.

#### **TEXT BOOKS:**

1. Dr. V. K. Raina, "Construction & Contract Management Practice", Shroff publishers and distributors pvt. Ltd. New Delhi.
2. B. N. Dutta, "Estimating and costing in civil engineering", 26th revised edition, UBS Publisher and distributor's pvt ltd, New Delhi.

#### **REFERENCE BOOKS:**

1. Maharashtra PWD Code book, 1986
2. Justice P. S. Narayana & S. R. C. Nayar, "Law of contracts with special reference to Tenders and Construction Agreement"
3. FIDIC- Construction, Insurance and Law- A discussion Document.
4. K.A.N. Taloasai, "Practical Aspect of Tendering and Contractual Operations of Civil Work", J. M. Jaina & Brothers, Delhi.

5. R. A. Sharma, "Handbook of Arbitration in Construction Contracts", Om Law Book House, Delhi.

6. D. Chandra Bose, "Business Law", PHI learning pvt ltd. New Delhi.

#### **2CM04 CONSTRUCTION QUALITY CONTROL AND MANAGEMENT (CQCM)**

**Unit-I -** Construction Quality Management ,Concept, Definition and evolution, inspection, Quality control and quality Assurance, Total quality Management, Cost of Quality, Construction Quality Assessment systems, Audit, Techniques of Quality Control, Deming, Juran & Philips Crosby concept of Quality, ISO Standards, Basic principles / concepts of Total Quality control and Management.

**Unit-II -** Practical Aspect of Quality Matter, Quality system in Architectural and structural Design, Drawing and Quality Audit, Aspects of Quality Management in Construction.

**Unit-III -** Major determinants of Quality control, Semantics of Quality, Quality Assurance Program (QAP), Templates for quality assurance, Quality dimensions for Earthwork, Quality dimensions for RCC work, Quality Audit in Construction works as per ISO 9000, Total quality Management in Building Design, Quality plan in Building construction, Quality Circles method and philosophy.

**Unit-IV -** Inspection benefits and item wise check list for Quality control, TQM in Building maintenance, Quality checking as per PWD / CPWD specifications and BIS codes

**Unit-V -** Quality Control of Potable Water supply, Practical application of Quality assurance and Quality control for Road/Highway project, Quality control tests and checking of Road sector.

**Unit-VI -** Contractor's quality assurance and Quality control plan, Laboratory for Quality control of construction works, Quality effect using modern materials and construction machinery. Quality control of service lines, water supply, drainage, sewerage, sanitary installations, Quality assurance circulars issued by CPWD.

#### **TEXT BOOK:**

1. S.C. Basu Roy, "Modern concept of Total Quality control and management for construction", A Nabhi Publication, New Delhi

**REFERENCE BOOKS:**

1. K. A, N, Talpasai, "Quality Dimensions in Civil construction", J. M. Jaina and brothers, Mori gate, Delhi -6
2. Kumar Neeraj Jha, "Construction Project Management ,Theory and Practice", Pearson Education, New Delhi ,17
3. Projects ,Planning, analysis, selection, financing, implementation and review by Prasanna Chandra, 7th edition, McGraw Hill Education India Pvt. Ltd., New Delhi.
4. P.S. Gahlot and Deep Gahlot, "Quality Management of Cement Concrete Construction", CBS Publishers and Distributors, New Delhi.

**2CM05 Elective- II (i) CONSTRUCTION SAFETY  
MANAGEMENT (CSM)**

**Unit- I-** Construction Safety Management , Evolution, Accident causation theories, Health and safety act and regulations, roles of safety personnel, Principles of Safety, Safety and health management system.

Causes of structural failure, design factor, construction error, material deficiencies, lack of maintenance and misuse of finished structures. Failure due to natural calamities, Instability, Hazard scenario, Working stress method for design of RCC and steel structure, comparison with limit state method, stability of foundation, safety plan.

**Unit-II-** Safety consideration in design of steel structure and RCC structures, Types, Shape of cracks, creep, shrinkage, crack control for watertight construction, Design strategy and site measures for crack control.

Corrosion and Related safety hazard ,Types , effect of corrosion, Principle of corrosion prevention and techniques for RCC and Steel structures, corrosion monitoring, Safety Hazard due to Excessive Deflection, Load deflection behavior of steel structure, RCC Structure and Pre-stressed concrete structure, Methods of Controlling deflection.

**Unit-III-** Fire Safety ,Assessment of fire hazard, Fire load, Fire & Ignition temperature, Fire resistant properties of building material, effect of fire, Principles for construction of fire resistant structure, Guide line for fire safety & management of industrial building, Fire fighting methods, Fire protection of old buildings.

**Unit-IV -** Safety against Noise Pollution, Properties of noise and sound, Effect of noise on work place, physical and mental health, Noise threshold limit, Control techniques for reducing noise level, Safety against Mechanical shock and Vibration, Types of shocks, Characteristics of shock motion, impact of impulsive forces, Safety against Natural calamities, Earthquake, Landslides, Flood, Safety against wind Hazard, Safety in material handling and transportation.

**Unit-V -** Safety practice during construction, Excavation, concreting work, Fabrication and Erection, masonry work, other building works, safety hazard due to bad workmanship, Post construction Safety Management, Safety Management in Rehabilitation of structure, Safety during Demolition and dismantling of structure.

**Unit-VI-** Safety and Reliability, Characteristics, functions, design consideration, quality control, performance evaluation, controlling safety hazard in Industrial and General Building construction work, Disaster Management at construction sites.

**TEXT BOOK:**

1. S. K. Bhattacharjee, "Safety Management in Construction ,Principles and practice", Khanna Publishers, New Delhi

**REFERENCE BOOKS:**

1. R. K. Mishra, "Construction Safety", AITBS Publishers India, Delhi
2. Indian Road Congress(IRC), Ministry of Road Transport and Highway- Highway Safety Code (IRC: SP-44)
3. BIS-GOI , Hand Book on Construction Safety Practices SP-70
4. R. E. Levitt and N. M.Samelson , "Construction Safety Management", Mc. Graw Hill Book Company, Inc., N. Y.
5. Kumar Neeraj Jha, "Construction Project Management ,Theory and Practice", Pearson Education, New Delhi ,17
6. R. K. Jain, Sunil S. Rao, "Industrial Safety, Health and Environment Management system", Khanna Publishers, New Delhi

**2CM05 Elective-II (ii) CONSTRUCTION PROJECT MANAGEMENT  
INFORMATION SYSTEM (CPMIS)**

**Unit-I-** Fundamental Concept, Importance, nature & scope, Structure and classification, elements of MIS, Information and system. Human as an Information processing system, Changing concepts and enabling role of Information System.

- Unit-II-** Business process Re-engineering and model of organization, Information Technology, Computer Hardware, software and programming language, Traditional & modern approach, structure, system, advantages, Normalization and types of database management, SQL in Database Management, Types, channel & characteristics, Hardware, networks and application.
- Unit-III-** E-business, Internet and World Wide Web, Intranet/Extranet, Security in E-business, Electronic Payment System, Impact of web on Strategic Management, Web Enabled Business Management, MIS in Web Environment.  
Application of Simon's Model, types, alternatives, necessity and systems of Decision Making, Application in Personnel, Financial, Production, Raw Material and Marketing Management, Enterprise Resource Planning, Model, Modules, Benefits, Product Evaluation and Implementation, Supply chain Management, Customer Relationship Management.
- Unit-IV-** Stages & Approaches of System Development, Requirement Determination and its strategies, System Analysis Tools, Concept, objectives, methods and details of System Design, Client-Server Architecture and implementation strategies
- Unit-V-** Architecture, design, justification, Organization & management, Implementation of Data Warehouse, Business Intelligence, data Warehouse, MIS.  
Management and Maintenance ,Implementation, hardware & software selection, System Maintenance, Evaluation, security and controls of Information System, Information system planning, Nolan Stage, four-stage Model and Selection Methodology of Information system, Information Resource Management and Organization Structure and Location.
- Unit-VI-** Project Management Information System (PMIS) ,Importance, PMIS framework, Project data management ,structuring, codification and reporting of data, Information retrieval software, Information communication, project document management, Role of Project management Office (PMO) in Multi projects Environment, Factor Influencing PMIS success.  
Case Studies covering aspects of MIS, Legal and ethical issues, issues of digital economy, cyber crimes, privacy, Information technology Act 2000.

**TEXT BOOK:**

1. D P Goyal, Management Information Systems- Managerial Approach, Macmillan India Ltd

**REFERENCE BOOKS:**

1. Waman S Jawadekar, Management Information Systems-Third Edition, The McGraw-Hill Companies
2. James A O'Brien, George M Marakas, Management Information Systems, The McGraw-Hill Companies
3. P.T. Josep, S.J, Sanjay Mohapatra, Management Information Systems in Knowledge Economy, PHI Learning Private Limited
4. K. K. Chitkara, "Construction Project Management, Planning, schedule and controlling (second edition)" Tata McGraw Hill Education pvt. Ltd, New Delhi.

**2CM05 Elective -II (iii) ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION (ECTBC)**

- Unit I-** Introduction- Fundamentals of energy, Energy Production Systems-Heating, Ventilating and Airconditioning, Solar Energy and Conservation, Energy Economic Analysis, Energy, conservation and audits, Domestic energy consumption, savings, challenges, primary energy use in buildings, Residential, Commercial, Institutional and public buildings, Legal requirements for conservation of fuel and power in buildings.
- Unit II-** Environmental, Energy and resource conservation, Design of green buildings, Evaluation tools for building energy, Embodied and operating energy, Peak demand, Comfort and Indoor Air quality, Visual and acoustical quality – Land, water and materials, Airborne emissions and waste management.
- Unit III-** Design-Natural building design consideration – Energy efficient design Strategies, Contextual factors, Longevity and process Assessment, Renewable Energy Sources and design, Advanced building Technologies, Smart buildings, Economies and cost analysis.
- Unit IV-** Services-Energy in building design, Energy efficient and environment friendly building, Thermal phenomena, thermal comfort, Indoor Air quality, Climate, sun and Solar radiation, Psychometrics, passive heating and cooling systems, Energy Analysis, Active HVAC systems, Preliminary Investigation, Goals and policies.
- Unit V-** Energy audit- Types of Energy audit, Analysis of results, Energy flow diagram, Energy consumption / Unit Production, Identification of wastage, Priority of conservative measures, Maintenance of energy management programme, Energy

Management, Energy management of electrical equipment, Improvement of power factor, Management of maximum demand

**Unit VI -** Energy savings in pumps, Fans, Compressed air systems, Energy savings in Lighting systems, Air conditioning systems, Applications Facility operation and maintenance, Facility modifications, Energy recovery dehumidifier, Waster heat recovery, Steam plants and distribution systems, Improvement of boiler efficiency, Frequency of blow down, Steam leakage, steam Flash and condense return

**TEXT BOOK:**

1. Moore F., Environmental Control system Mc Graw Hill, Inc. 1994.

**REFERENCES BOOKS:**

1. Brown, GZ, Sun, Wind and light: Architectural design strategies, John Wiley & Sons, 1985.
2. Cook, J, Award – Winning passive Solar Design, Mc Graw Hill, 1984.
3. J.R. Waters, Energy conservation in Buildings: A Guide to part L of the Building Regulations, Blackwell Publishing, 2003.
4. W. R. Murphy, G. Mckay – Enegrgy Management, , Elsevier , Butterworth-Heinemann
5. David R. Hyde, Robert Grrow – Energy System for Residential Buildings, TataMcGraw Hill-1999

**2CM05 Elective -II (iv) BUILDING SERVICES IN CONSTRUCTION ENGINEERING (BSCE)**

**Unit I -** Brief Planning of Building services, classification based on Occupancy as per NBC, FAR considerations, Standards of accommodations, Tube well, Pumps and Piping, Selection criteria, Characteristics, Classification, Principles of operation, Types, Design, Performance, Installation and cost consideration

**Unit II -** Lifts and Escalators- History, Anatomy, provisions, Classification, Types of Lift, Lift codes and rules, Traffic analysis and selection of lifts, Types of lift controls speed, Types of lift operators, Structural provisions, Installation details of brakes, ropes, gears etc. Escalators, design features and working, types of escalators.

**Unit III -** Fire Fighting Services – Fire growth and behavior in building, Classification of fire, Classification of building materials,

structural components and building according to fire, Codes and Municipal rules, Modes of fire, Fire fighting, suitability, type and installation and use, hydrant system installation, Provisions in buildings from fire safety angles, Fire alarm systems, Fire detectors, Smoke detectors, heat detectors etc.

**Unit IV -** Acoustics and Integrated services– Noise in building, Provisions for noise absorptions, systems for noise control in buildings, HVAC systems and services, components, construction and types of HVAC Systems, Design and Installation of air conditioning systems for building, Building security and access control systems in building, Types, method and its application in building

**Unit V -** Designing different services in Auditorium– Space attributes, stage equipments, Stage lighting systems and lighting accessories, floodlights, Spotlights, projectors, smoke machine, Lighting control tools, audio Visual equipments, Other services for auditorium like loudspeaker, snaks counter, video conferencing systems, air conditioning etc.

**Unit VI -** Design of car perking systems, car parking management, multi level car parking, siemens sipark parking guidance system, safety of parking area, car perking ventilation, design of impulse ventilation system, Security services in buildings, access control systems features, Intruder systems, Intercom and emergency communication systems, smart cards and biometrics, building signage, Laundry planning and design.

**TEXT BOOK:**

1. V. K. Jain, Hand book of designing and installation of services in High Rise building complexes, Khana Publishers, Delhi

**REFERENCES BOOKS:**

1. Arora and Bindra, Building Construction, Dhanpat Rai, 2012.
2. Hand Book of Housing Statistics, NBO, 2003.
3. National Building Code of India, Bureau of Indian Standards, 2005.

**2CM06 CONSTRUCTION FINANCE & ACCOUNTING MANAGEMENT - LAB**

- a) Student will do various exercise related with Construction Projects Planning and Management (CPPM) using software like Primavera, M-S Project and other software and submit it in Journal.
- b) Financial Modeling using spread sheets

- c) Inventory Control of tools and equipment using spread sheet or like software
- d) Preparation of Contract and Tender document for typical work.
- e) Preparing Quality analysis & report, filling relevant Forms for Quality control and Assurance of construction work.  
A visit to relevant construction industry / organization / site is suggested.

## **2CM07 SEMINAR–II**

The Seminar shall be based on the recent trends in the field of Construction Engineering and Management preferably related to the subjects 2CM01 to 2CM05. It should be surveyed from the technical literature published in International / National journals. A report should be prepared following the guidelines of IEI Journal paper format, submitted and followed by the presentation

## **3CM01 SEMINAR AND DISSERTATION**

Internal Seminar based on the dissertation work completed during third semester (Please refer teaching scheme)

## **4CM01 SEMINAR AND DISSERTATION**

External Seminar based on the dissertation work completed during fourth semester. (Please refer teaching scheme)

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## **SYLLABUS PRESCRIBED FOR M.E. ELECTRICAL ENGINEERING (ELECTRONICS & POWER)**

### **SEMESTER - I**

#### **1EPM01 DIGITAL CONTROL SYSTEMS**

**Unit I:** Signal Processing in Digital Control: Configuration of the Basic Digital Control Scheme, Principles of Signal Conversion, Basic Discrete-Time Signals, Time-Domain Models for Discrete-Time Systems, z-transform, Transfer Function Models, Frequency Response, Stability on the z-plane and the Jury stability criterion, Sample-and-Hold Systems, Sampled Spectra and Aliasing, Reconstruction of Analog Signals, Principles of Discretization.

**Unit II:** Models of Digital Control Devices and Systems: z-domain description of Sampled Continuous-Time Plants, z-domain description of Systems with Dead-Time, Implementation of Digital Controllers, Tunable PID Controllers, Digital Temperature Control System, Digital Position Control System, Stepping Motors and their Control.

**Unit III:** Design of Digital Control Algorithms: Introduction, z-plane specifications of Control System Design, Digital Compensator design using Frequency Response Plots, Digital Compensator design using Root Locus Plots, z-plane synthesis.

**Unit IV:** Control System Analysis Using State Variable Methods: Vectors and Matrices, State Variable Representation, Conversion of state variable models to transfer functions, Conversion of transfer functions to Canonical State Variable Models, Eigen values and Eigen vectors, Solution of state equations, Concepts of Controllability and Observability.

**Unit V:** State Variable Analysis of Digital Control Systems: State descriptions of Digital Processors, State Description of Sampled Continuous-Time Plants, State Description of Systems with Dead-Time, Solution of State Difference Equations, Controllability and Observability, Multivariable Systems.

**Unit VI:** Pole-Placement Design and State Observers: Stability Improvement by State Feedback, Necessary and Sufficient Conditions for arbitrary Pole-Placement, State Regulator Design, Design of State Observers, State Feedback with Integral Control, Digital Control Systems with State Feedback.

**TEXT BOOK :**

1. M. Gopal, Digital Control and State Variable Techniques, TMH.

**REFERENCE BOOKS :**

1. Katsuhiko Ogata Digital Control Engineering, PHI.
2. Kuo B. C. Digital Control Systems, Wiley & Sons
3. Ioan Dor Landau and Gianluca Zito, Digital Control Systems, Springer.
4. M. Sami Fadali, Antonio Visioli, Digital Control Engineering: Analysis and Design , AP.

**1EEPME2 POWER ELECTRONIC CONVERTERS**

**UNIT I:** Semiconductor Devices: Review of Semiconductor devices like Power BJT, SCR, MOSFET, IGBT, GTO, MCT; Static and dynamic characteristics of these devices; Single quadrant, Two quadrant and bid-directional switches.

**Unit II:** Switching Voltage Regulators: Linear voltage regulators; Switching voltage regulators; Review of basic dc-dc voltage regulator configurations -Buck, Boost, Buck-Boost converters and their analysis for continuous and discontinuous mode; Fly back converter, Forward converter, Push-pull converter, Cuk converter, Sepic Converter; Design criteria for SMPS; Multi-output switch mode regulator.

**Unit III:** Design of Magnetic Components: Design of power transformer; high frequency transformers for fly back, forward, half-bridge–full Bridge and push pull converters; Design of inductors for various converter topologies; Design of current transformers; Different types of core materials.

**Unit IV:** DC-AC converters/Inverters: Classification; Review of line commutated inverters; Bridge inverters with 120°, 180°, and 150° modes of operation; Harmonic reduction techniques; Sine-triangular PWM; Space Vector Pulse Width Modulation; Current Source Inverters.

**Unit V:** Gate and Base drive circuits: Preliminary design considerations; DC coupled drive circuits with uni polar and bipolar outputs; Importance of isolation in driver circuits; electrically isolated drive circuits; Some commonly available driver chips (based on boot-strap capacitor); Cascade connected drive circuits;

Thyristor drive circuits; Protection in driver circuits; Blanking circuits for bridge inverters.

**Unit VI:** Three phase AC voltage controllers and Cyclo-converters: Review of On-off and phase control; Three phase half-wave and full wave controllers and their analysis with resistive loads; three phase bi-directional delta connected controllers; 3-phase cyclo-converter circuits; circulating current operation; non-circulating current operation; mean output voltage and harmonics in supply current waveform

**TEXT BOOK:**

1. Ned Mohan, Undeland and Robbins, Power Electronics: Converters, Applications and Design (Wiley)

**REFERENCE BOOKS:**

1. Rashid M.H., Power Electronics, Pearson Education
2. G.K. Dubey, Doradla, Joshi, Sinha, Thyristorised Power Controllers Wiley
3. Sen P.C., Power Electronics, Tata McGraw Hill.
4. Philip T.Krein, Elements of Power Electronics, Oxford University Press.

**1EEPME3 ADVANCED DIGITAL SIGNAL PROCESSING**

**Unit-I-** Review of Discrete time systems, LTI systems, Impulse response and frequency response. Discrete convolution. Discrete Fourier Transform and Fast Fourier Transforms, Inverse DFT, Algorithms for efficient computation of DFT and FFT. Fast convolution. Correlation.

**Unit-II-** Implementation of DSP algorithms, Block diagram and signal flow graph representations, Basic IIR and FIR filter structures, Cascaded, parallel and lattice realizations, computational complexity. Finite word length effects and quantization errors.

**Unit-III-** Digital filter design. FIR and IIR filters, linear phase filters, design techniques for IIR filters using analog filter transformation methods, design techniques for FIR filters using windowing method. Analysis of finite word length effects.

**Unit-IV -** Estimation of Auto-correlation and Power Spectra of random signals. Nonparametric methods – averaging periodograms, Welch method, Blackman and Tukey method, Parametric

methods, AR, MA and ARMA models, Yule Walker method, Levinson-Durbin algorithm.

**Unit-V -** Multi-rate digital signal processing, Poly-phase decomposition, multistage decimators and interpolators, Digital filter banks. Adaptive filtering, minimum mean square error criterion, Wiener filter, LMS adaptive algorithm.

**Unit-VI -** General purpose DSP processors, Implementation of DSP algorithms on General purpose processors: issues, advantages & disadvantages . Special purpose DSP processors –Hardware digital filters and FFT processors.

**TEXT BOOK:**

Proakis and Manolakis Digital Signal Processing: Principles, Algorithms and Applications: 3rd Ed.-Prentice-Hall (India)

**REFERENCE BOOKS:**

1. S.Mitra, Digital Signal Processing: A Computer Based Approach: Tata McGraw Hill
2. Oppenheim & Schafer, Discrete Time Signal Processing, PHI.
3. Defatta, Digital Signal Processing, Wiley Inter-Science.
4. Ifeachor & Jervis, Digital Signal Processing , Pearson Education

**1EEMPME4 POWER SYSTEMS MODELLING & SIMULATION**

**Unit-I-** Network Formulation and Graph Theory: Introduction, Network Equations ,Graph Theory, Development of Network Matrices from Graph Theoretic Approach, Augment Cut set Incidence Matrix Cut set and Circuit Equations, Building Algorithm for the Bus Impedance, Matrix modification of ZBUS matrix due to changes in the primitive network.

**Unit-II-** Load Flow Studies: Introduction, Different techniques such as Gauss Seidal method, Newton Raphson method, De-Coupled method, Fast Decoupled method, Modified Fast Decoupled, Concept of Optimal Power Flow, Solution of Optimal power flow by Gradient method, Solution of Optimal power flow by Newton's method.

**Unit-III-** Power System Security: Introduction, Factors Affecting Power System Security, Short Circuit Studies of a Large Power System Networks, Symmetrical Fault Analysis Using Bus Impedance

Matrix, Algorithm for Formation of Bus Impedance Matrix, Contingency Analysis: Detection of Network Problems, Overview of security analysis, Linear Sensitivity Factors, Contingency Selection, Concentric Relaxation, Bounding.

**Unit-IV -** State Estimation in Power Systems: Introduction, Power system state estimation, Maximum Likelihood Weighted Least Squares Estimation, Introduction, , Maximum Likelihood Concepts, Matrix Formulation, State Estimation of an AC network, Development of Method, State Estimation by Orthogonal Decomposition, Application of Power Systems State Estimation.

**Unit-V -** Sparsity Techniques and Transients Stability of Power Systems: Introduction, Sparse System , Theorems of Sparse matrix method , Various application areas and sparsity, Direct solution of sparse network equations by optimally ordered triangular factorization. Electromagnetic Transient Simulation: Introduction, Traveling waves on transmission lines, Successive Reflections, Bewle Lattice Diagram, Multi machine Systems, Multi machine Transient Stability.

**Unit-VI-** Numerical Integration Techniques:One step methods, Taylor series based methods, Forward -Euler's method, Runge-Kutta methods, Trapezoidal method, backward-Euler's method, Accuracy and error analysis, Numerical stability analysis, Stiff systems, Step-size selection, Differential algebraic systems, Power system applications: Transient stability analysis.

**TEXT BOOK:**

Mariesa Crow: Computational Methods for Electric Power Systems, CRC Press.

**REFERENCE BOOKS:**

1. A. J. Wood and B. F. Wallenberg: Power Generation Operation & Control, John Wiley & Sons, Inc, 1996.
2. Jos Arrillaga and Bruce Smith: AC-DC Power System Analysis, IEE London UK, 1998.
3. L. P. Singh : Advanced Power System Analysis and Dynamics, New Age International Ltd, New Delhi, 1992.
4. Hadi Sadat: Power System Analysis, Tata McGraw Hill, New Delhi, 1999.



**1EPMEE5 MODELLING & ANALYSIS OF ELECTRICAL MACHINES**

**Unit-I:** Introduction to the theory of basic two pole machine applicable to DC Machines, Three-phase induction machines and synchronous machine. Kron's primitive machine, Need of modeling, Introduction to modeling of electrical machines, Voltage and Torque equations.

**Unit-II:** Concept of transformation: change of variable & machine variable and transform variable for arbitrary reference frames. Application to DC machine for steady state and transient analysis, Equation of cross field commutator machine.

**Unit-III:** Polyphase Induction Machines: Voltage and torque equations, Equivalent circuit, Steady state analysis, Dynamic performance during sudden change in load torque and three phase fault at the machine terminals.

**Unit-IV:** Polyphase synchronous Machine: Voltage and Torque equations in stator, rotor and air gap field reference frame. Transformation and transformed equations. Park transformation, Voltage and power equation for salient and non-salient alternator, their phase diagrams.

**Unit-V:** Dynamic analysis of interconnected Machines: Machine interconnection Matrices. Transformation of voltage and torque equation using interconnection matrix. Large signal transient analysis using transformed equations. The DC generator/DC Motor system. The alternator/synchronous system.

**Unit-VI:** Linearized machine equations: Linearization of machine equation, small displacement stability: Eigen values of typical induction machine and synchronous machine, transfer function formulation.

**TEXT BOOK :**

Paul C. Krause, O Wasynczuk, S D. Sudhoff, "Analysis of Electric Machinery", IEEE Press.

**REFERENCE BOOKS :**

- 1) B. Adkins, "The Generalized theory of Electrical Machine", McGraw-Hill.
- 2) P.S. Bhimbra, "Generalised theory of Electrical Machines", Khanna Publishers.

- 3) C. V. Jones, Butterworth "The Unified theory of Electrical Machines", Wiley.
- 4) Boldia and S.A. Nasar, "Electrical Machine Dynamics", Macmillan Press.

**1EPMEE6****SEMINAR**

The Seminar shall be based on the recent trends in the field of electrical, electronics & power engineering preferably related to the subjects 1EPMEE1 to 1EPMEE5. It should be surveyed from the technical literature published in international /national journals. A report should be prepared following the guidelines of IEEE paper format, submitted and followed by the presentation.

**1EPMEE7 POWER ELECTRONIC CONVERTERS - LAB**

Minimum twelve experiments (two experiments per unit) based on the syllabus of 1EPMEE2 Power Electronic Converters.

**SEMESTER - II****2EPMEE1****DIGITAL PROTECTION OF POWER SYSTEMS**

**Unit-I:** Basic Elements of Digital Protection: Application of Numerical relays for Interconnected power system networks, Basic Components of a Digital Relay, Signal Conditioning Subsystems, Transducers, Surge Protection Circuits, Analogue Filtering, Analogue Multiplexers, Conversion Subsystem, Digital Multiplexing, Digital Relay Subsystem, Benefits of digital relays.

**Unit-II:** Relay coordination of Interconnected Power System: Protection of an interconnected system, Link net structure, Flowchart of primary/Backup relay pairs, Flowchart of Time Multiplier Setting. Examples based on existing power system networks.

**Unit-III:** Load-Shedding and Frequency Relaying: Introduction, Rate and Frequency Decline, Load-Shedding, Frequency Relays, Induction-Cylinder under frequency Relays, Digital frequency Relays, microprocessor-Based Frequency Relay, Formulating a Load-Shedding Scheme, Maximum Anticipated Overload, Number of Load-Shedding Step, Size of the Load Shed at Each Step, Frequency Settings, Time Delay.

**Unit-IV:** Reclosing and Synchronizing: Reclosing Precautions, Reclosing System consideration, Selective Reclosing, Deionizing Times

for Three-Pole Reclosing, Live-Line/Dead-Bus, Live-Bus/Dead-Line Control, instantaneous-Trip Lockout, Intermediate Lockout, Reclosing Relays and Their Operation, Review of Breaker Operation, Single-Shot Reclosing Relays, Multi shot Reclosing Relays, Phasing Voltage Synchronism check characteristic, Angular Synchronism check characteristic.

**Unit-V:** Developments in New Relaying Principles: Traveling Wave Based Protection of Transmission Lines, Frequency Based Relaying, Series Compensated Line Protection: Degree of compensation, Voltage Profile of Series Compensated Line, Faults with Unbypassed Series Capacitors, Relay Problems Due to compensation, Voltage and Current Inversion, Problems in reach measurement, Protection of Series compensated line. Concept of Adaptive Relaying, Fault Location Algorithms.

**Unit-VI:** Concept of Different Relay Algorithms: Introduction of different techniques, least square based methods, Introduction, Integral LSQ fit, Power series LSQ fit, Differential equation Based techniques, Basic principles, Digital harmonic filtering by selected limits, Fourier analysis based techniques, Introduction, The full cycle window algorithm, The half cycle window algorithm.

#### **TEXT BOOK:**

L.P. Singh: “Digital Protection”, New Age International (P) Ltd., New Delhi, (2/e).

#### **REFERENCE BOOKS:**

1. Walter A Elmore, Protective Relaying Theory & Applications, Marcel Dekker Inc; New York.
2. J. L. Blackburn, “Protecting Relaying,” Marcel Dekker Inc; New York, 1998.
3. S. H. Horowitz, A. G. Phadke “Power System Relaying” John Wiley & Sons, New York, 1996.
4. P. M. Anderson , Power System Protection, IEEE Press, Wiley InterScience, New York, 1999.

### **2EPPME2 DIGITAL INSTRUMENTATION**

**Unit-I** Introduction: The basis of measurement, International unit system, Measurement &Electrical standards, Measurement errors, Factors influencing measurement errors, Enabling technologies: Processor based components and system components, Semicustom and custom ICs, Display devices.

**Unit-II-** Data converters: Sampled data systems, A-to-D converter errors, Basic SHA operation, ADC architectures, D to A converters, DAC architectures, Data acquisition system interfaces.

**Unit-III-** Waveform parameters and amplitude related measurements, Digital multimeters. DMM specifications. Pulse parameters and measurements, Fundamentals of oscilloscopes: basic operation, Digital storage oscilloscopes.

**Unit-IV -** Electronic counters: Basic counter circuitry, Modes of operation, Accuracy of counters, High frequency measurements and down conversion techniques, Modulation domain analysers. Signal generators. Arbitrary waveform generators (AWG).

**Unit-V -** Spectrum analysis: Dynamic signal analysis, Types of spectrum analyser, Superheterodyne spectrum analyser, Logic analysers: Basic operation, Types of analysis, Probing, Clocking, Triggering. Advanced features and measurement techniques.

**Unit-VI-** Instrument buses and VLSI testing: IEEE-488 bus, major specifications, GPIB operation, GPIB devices and interface functions, GPIB applications. VXIbus. The RS 232 interface. VLSI testing and automatic test equipment. Digital telecommunication transmission systems and associated Measurements: ADSL standard – ANSI T1.413, ADSL measurements.

#### **TEXT BOOK:**

Nihal Kuluratna “Digital and Analog Instrumentation” The Institution of Engineering and Technology, London.

#### **REFERENCE BOOKS:**

1. Bouwens ,A.J.”Digital instrumentation.” McGraw Hill, 1984.
2. John Lenk,D.”Handbook of Microcomputer based instrumentation and control”,PHI1984
3. Doebelin “Measurement System ,Application and Design”,(4/e),McGrawHill,1990.
4. Evans D. S. “ Fundamentals of Digital Instrumentation”, Hilger & Watts.

### **2EPPME3 EMBEDDED SYSTEMS DESIGN**

**Unit-I-** Embedded systems introduction: Processor technologies, implementation technologies, and design technologies. General-purpose processors and the 8051: Architecture, instruction set and programming environment.

- Unit-II-** Single-purpose processors: Standard peripheral processors :timers/counters, UARTs, A/D, D/A, PWM, etc. and designing custom processors ,combinational logic design, sequential logic design, custom processor design.
- Unit-III-** System Integration: Memories (ROM, RAM, compositions), Interfacing (serial/parallel, interrupt-driven, parallel), Arbiters. Common interfacing protocols: PCI, ISA, I2C, CAN.
- Unit-IV-** Computational models and describing behavior: sequential program, state machines, dataflow. Finite state machines. Concurrent process model. Implementation technologies: Custom VLSI, standard cell and gate array, programmable logic devices (including FPGAs).
- Unit-V-** Real time Operating System Concept: Architecture of kernel, task scheduler, Process and Threads. ISR, Inter Process Communication through Semaphores, mailbox, message queues, pipes. Events, timers and memory management, RTOS services in contrast with traditional OS.
- Unit-VI-** Embedded Linux; Introduction to the Linux kernel, Configuring and booting the kernel, the root file system, Root file directories, Linux file systems, Types of file system: Disk, RAM, Flash, Network. TCP/IP Networking- Network configuration, Device control from user space- Accessing hardware directly, Inter Process Communication- Linux process model and IPCs.

**TEXT BOOK :**

Frank Vahid, Tony Givargis “Embedded System Design “, PHI.

**REFERENCE BOOKS:**

1. Rajkamal, “ Embedded Sytems “TMH
2. David Simon “Embedded Systems Software Primer” Pearson.
3. Steve Heath, “Embedded System Design”, Elsevier.
4. Marwedel, Peter. “Embedded Systems Design” , Springer.

**2EPM4 Elective -I (i) POWER ELECTRONIC  
CONTROLLED DRIVES**

- Unit I:** Phase-Controlled DC Motor Drives: Principles of DC Motor Speed Control, Armature and Field Controls, Four Quadrant operation, Phase controlled converters, Control modeling of the Three-Phase converter, Converter configuration for a Four-

Quadrant DC Motor Drive, Three-Phase Converter-Controlled DC Motor Drive, Design of Controllers.

- Unit II:** Chopper-Controlled DC Motor Drive: Principle of operation of the Chopper, Four quadrant Chopper circuit, Model of the Chopper, Steady-State analysis of Chopper-Controlled DC Motor Drive, Pulsating Torques, Closed-Loop operation, Speed-Controlled DC Motor Drive.
- Unit III:** Phase-Controlled Induction Motor Drives: Stator-Voltage Control, Steady-state analysis, Approximate analysis, Torque-Speed Characteristics with Phase Control, Slip-Energy Recovery Scheme, Steady-state analysis, Starting, Rating , Closed-Loop Control.
- Unit IV:** Frequency-Controlled Induction Motor Drives: Voltage-Source Inverter, Voltage-Source Inverter-Driven Induction Motor, Speed control, Constant Volts/Hz Control, Constant Slip-Speed Control, and Constant-Air Gap-Flux Control.
- Unit V:** Vector-Controlled Induction Motor Drives: Principle of Vector control, Direct Vector control, Derivation of Indirect Vector-Control Scheme, Indirect Vector-Control Scheme, and Implementation of Indirect Vector-Control Scheme.
- Unit VI:** PM Brushless DC Motor (PMBDCM): Modeling of PM Brushless DC Motor, PMBDCM Drive Scheme, Phase Advancing, Half-Wave PMBDCM Drives, Sensorless Control of PMBDCM Drive, Design of Current and Speed Controllers.

**TEXT BOOK:**

R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Pearson Education.

**REFERENCE BOOKS:**

1. Ned Mohan, Undeland, Robbins, “Power Electronics” ,Wiley.
2. G.K. Dubey, Doradla, Joshi, Sinha, “Thyristorised Power Controllers”, Wiley.
3. Rashid M.H., “Power Electronics”, Pearson Education.
4. B.K.Bose, “Power Electronics and Motor Drives”, Elsevier.

## **2EEMPME4 Elective -I (ii) POWER SYSTEMS PLANNING & RELIABILITY**

- Unit I:** Load Forecasting: Load Forecasting Categories-Long term, Medium term, short term, very short term Applications of Load Forecasting, Factors Affecting Load Patterns.
- Unit II:** Medium and long term load forecasting methods- end use models, econometric models, statistical model based learning. Short Term Load Forecasting (STLF): Applications of Load Forecasting, methods.
- Unit III:** Power System Reliability: Basic Notions of Power System Reliability- sub systems, reliability indices, outage classification, value of reliability tools, Concepts and methodologies, power system structure, Reliability based planning in power systems, Effect of failures on power system, Planning criteria, Risk analysis in power system planning, multi-state systems.
- Unit IV:** Basic Tools and Techniques- random processes methods & Markov models, Computation of power system reliability measures by using Markov reward models, Evaluation of reliability indices, Universal
- Unit V:** Generating Function (UGF) Method, Monte Carlo simulation. Reliability of Generation Systems- capacity outage calculations, reliability indices using the loss of load probability method, unit commitment and operating constraints, optimal reserve management, single and multi-stage expansion,
- Unit VI:** Reliability Assessment for Elements of Transmission and Transformation Systems- reliability indices of substations based on the overload capability of the transformers, evaluation and analysis of substation configurations, Reliability analysis of protection systems for high voltage transmission lines.

### **TEXT BOOK:**

D. Elmakias “Computational Methods in Power System Reliability”, Springer-Verlog.

### **REFERENCE BOOKS:**

1. Shahidehpour M, Yamin H, Li Z Marke Operations in Electric Power Systems Forecasting, Scheduling, and Risk Management, John Wiley& Sons.

2. Billinton R, Allan R, Reliability Evaluation of Power Systems, Plenum Press NY.

## **2EEMPME5 Elective -II (i) FLEXIBLE AC TRANSMISSION SYSTEMS**

- UNIT-I** Introduction to Facts Controllers: Reactive power control: Reactive power, uncompensated transmission line, reactive power compensation – Principles of conventional reactive power compensators: Synchronous condensers, saturated reactor, phase angle regulator, and other controllers.
- UNIT-II** Thyristor Controlled Shunt Compensator: SVC Objective of shunt compensation – Principle and operating characteristics of Thyristor Controlled Reactor – Thyristor Switched Capacitor – TSC-TCR static Var Compensators –
- UNIT-III** SVC control system – SVC voltage regulator model – Transfer function and dynamic performance of SVC – Transient stability enhancement and power oscillation damping, mitigation of sub synchronous resonance.
- UNIT-IV** Thyristor Controlled Series Compensator: TCSC Series compensation – Principles of operation of TCSC – Capability characteristics of TCSC – Modeling of TCSC – TCSC control system – enhancement of system damping – mitigation of sub synchronous resonance.
- UNIT-V** Voltage Source Converter Based Shunt and Series Compensator: STATCOM: (Static Synchronous Compensator) Principle of operation, VI Characteristics, Harmonic performance – Steady state model. SSSC: (Static Synchronous Series Compensator) Principle of operation and characteristics of SSSC– control scheme for SSSC.
- UNIT-VI** Unified Power Flow Controller: Basic operating principles – conventional transmission control capability of UPFC – Independent real and reactive power flow control – control scheme for UPFC – Basic control system for P and Q control – dynamic performance.

### **TEXT BOOK:**

Narani.G.Hingorani and Laszlo Gyugyi, “Understanding FACTS”, First Indian Edition, 2001, IEEE Power Engineering Society Sponsor, IEEE Press.

**REFERENCE BOOKS:**

1. T J E Miller, "Reactive Power Control in Electric Systems", John Wiley.
2. Hingorani N G, "High Power Electronics and Flexible AC Transmission Systems", IEEE High Power Engineering Review, 1998.
3. Padiyar K R "FACTS Controllers in Power Transmission & Distribution", New Age.
4. R. Mohan and R.K.Varma, "Thyristor-Based FACTS Controllers for Electrical Transmission Systems", IEEE Press.

**2EETME5 Elective -II (ii) NEURO FUZZY CONTROL**

**Unit-I-** Fuzzy Logic for Control :Fuzziness and linguistic rules , Fuzzy sets in control ,Combining fuzzy sets , Sensitivity of functions Combining fuzzy rules ,Truth tables for fuzzy logic , Fuzzy partitions , Fuzzy relations ,Defuzzification Level curves , alpha-cuts ,Universal approximation.

**Unit-II-** Fuzzy Control: A fuzzy controller for an inverted pendulum, Main approaches to fuzzy control, Stability of fuzzy control systems. Fuzzy controller design.

**Unit-III-** Neural Networks for Control: Introduction to neural network, implementing neural networks, Learning capability, the delta rule, the back propagation algorithm, Practical issues in training.

**Unit-IV-** Neural Control : Neural networks in control ,Inverse dynamics ,Neural networks in direct neural control A neural network for temperature control , Simulating PI control with a neural network Neural networks in indirect control ,System identification, Linearization.

**Unit-V-** Fuzzy-Neural and Neural-Fuzzy Control : Fuzzy concepts in neural networks, Basic principles of fuzzy-neural systems ,Basic principles of neural-fuzzy systems ,Adaptive network fuzzy inference systems ,ANFIS learning algorithm ,Generating fuzzy rules

**Unit-VI-** Applications of neural control to current control and speed control of induction motors, Fuzzy logic control of a synchronous generator set. Applications of neuro fuzzy control: Cooling scheme for laser materials, Color quality processing, Identification of trash in cotton and Integrated pest management systems.

**TEXT BOOKS:**

1. Hung T. Nguyen, A first course in Fuzzy and Neural Control, CRC Press.
2. M.N. Cirstea, A. Dinu, J.G. Khor,M. McCormick, Neural and Fuzzy Logic Control of Drives and Power Systems, Newnes Press.

**REFERENCE BOOKS:**

1. Fuller Robert; Introduction to Neuro Fuzzy Systems, Springer.
2. Lamba V. K. Neuro Fuzzy Systems, Laxmi Publications.
3. Jang, sun & Mizutani , Neuro-fuzzy And Soft Computing, PHI.
4. D. Nauck, F. Klawonn, R. Kruse: Foundations of Neuro-Fuzzy Systems, John Wiley.

**2EETME6 SEMINAR**

The Seminar shall be based on the recent trends in the field of electrical, electronics and power engineering preferably related to the subjects 2EETME1 to 2EETME5. It should be surveyed from the technical literature published in international /national journals. A report should be prepared following the guidelines of IEEE paper format, submitted and followed by the presentation.

**2EETME7 EMBEDDED SYSTEMS DESIGN -LAB**

Minimum twelve experiments ( two experiments per unit) based on the syllabus of 2EETME3 Embedded Systems Design using appropriate hardware and software.

**SEMESTER -III**  
**3EETME1 SEMINAR & DISSERTATION**

(As given in the scheme)

**SEMESTER -IV**  
**4EETME1 SEMINAR & DISSERTATION**

(As given in the scheme)