Annexure-II

Seventh Semester

Open Elective-2

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hours / week	Credit	Full Marks
1.	Open Elective - 2	OE CE 704	Project, Planning and Management.	2	0	0	2	2	100
2.	Open Elective - 2	OE CS 704	Soft Computing Techniques	2	0	0	2	2	100
3.	Open Elective - 2	OE EC 704	Basics of Electronic Devices and Circuits	2	0	0	2	2	100
4.	Open Elective - 2	OE EE 704	Non-Conventional Energy System	2	0	0	2	2	100
5.	Open Elective - 2	OE ME 704	Total Quality Management	2	0	0	2	2	100
6.	Open Elective - 2	OE CC 704	Building Construction Practice	2	0	0	2	2	100
7.	Open Elective - 2	OE ES 704	Real Time Embedded Systems	2	0	0	2	2	100
8.	Open Elective - 2	OE MI 704	Automobile Engineering	2	0	0	2	2	100

Project, Planning and Management

(Can be opted by students from all branches except CE and the students who had undergone similar course as program core or program elective)

Course Code	OE CE 704
Course Title	Project, Planning and Management
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	Nil
Course Category	Open Elective (OE)
Number of classes	26 hours

Course Outcomes: After completion of the course students will be able to-

CO No	CO Description	K-level
CO-1	Explain the characteristics and stages of projects.	K-2
CO-2	Illustrate the detailed construction planning.	K-2
CO-3	Evaluate project through CPM network.	K-6
CO-4	Explain resource scheduling and PERT analysis.	K-3

Course contents:-

Module 1: Introduction to Project Management (6 hours)

Characteristics of projects, Definition andObjectives of Project Management, Stages of Project Management, Project Planning Process,Establishing Project organization.

Module 2: **Construction Project Planning (7 hours)**

Stages of project planning: pre-tender planning,Pre-construction planning, detailed construction planning, role of client and contractor, levelof detail. Process of development of plans and schedules, work break-down structure, activityLists, assessment of work content, estimating durations, sequence of activities, activity utility data.

Module 3: **Techniques of Planning (7 hours)**

Bar charts, Networks: basic terminology, types ofPrecedence relationships: finish to start, start to start, finish to finish, start to finish,Preparation of CPM networks: activity on link and activity on node representation, analysis ofsingle relationship (finish to start) networks, computation of float values, critical and semi critical paths, calendaring networks.

Module 4: **Resource Scheduling** **(6 hours)**

Bar chart, line of balance technique, resource constraintsand conflicts, resource aggregation, allocation, smoothening and leveling. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion

References / Suggested Learning Resources:

1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India
2. Lock, Gower, Project Management Handbook.
3. Cleland and King, VNR Project Management Handbook.
4 Project Planning and Control Dr. B.C. PunmiaLaxmi Publications(P)
5. HoraldKerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
6. S. Choudhury, Project Scheduling and Monitoring in Practice.

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Soft Computing Techniques

(Can be opted by students from all branches except CSE and the students who had undergone similar course as program core or program elective)

Course Code	OE CS 704
Course Title	Soft Computing Techniques
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	Mathematics
Course Category	Open Elective-2
Number of classes	26 hours

Course Outcome:

After completing this course, the student should be able to-

CO Number	CO Description	K-level
CO-1	Understand soft computing techniques and their applications	K2
CO-2	Apply various neural network model to solve real-life problems	K3
CO-3	Learn fuzzy logic and its applications	K2
CO-4	Solve various optimization problems using genetic algorithm	K3

Course Content:

Module 1: Introduction (4 hours)

Artificial Intelligence – a Brief Review – Pitfalls of Traditional AI – Need for Computational Intelligence – Importance of Tolerance of Imprecision and Uncertainty - Constituent Techniques – Overview of Artificial Neural Networks - Fuzzy Logic - Evolutionary Computation
Introduction to soft computing, Major Areas & Applications of Soft Computing.

Module 2: Neural Network (8 hours)

Biological and Artificial Neuron, Neural Networks, Supervised and Unsupervised Learning. Single Layer Perceptron - Multilayer Perceptron – Backpropagation Learning.

Neural Networks as Associative Memories - Hopfield Networks, Bidirectional Associative Memory. Topologically Organized Neural Networks – Competitive Learning, Kohonen Maps

Module 3: Fuzzy Logic (7hours)

Fuzzy Sets – Properties – Membership Functions - Fuzzy Operations. Fuzzy Logic and Fuzzy Inference System. Some applications of Fuzzy logic.

Module 4: Genetic Algorithm (7 hours)

History of Genetic Algorithms (GA), Concept of "Genetics" and "Evolution", Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc., Solving single-objective optimization problems using Gas, Concept of multi-objective optimization problems (MOOPs) and issues of solving them.

References / Suggested Learning Resources:

1. Kumar S., "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2004.
2. Ross T. J., "Fuzzy Logic with Engineering Applications", McGraw Hill, 1997.
3. Eiben A. E. and Smith J. E., "Introduction to Evolutionary Computing", Second Edition, Springer, Natural Computing Series, 2007.
4. Engelbrecht A. P., "Fundamentals of Computational Swarm Intelligence", John Wiley & Sons, 2006.
5. Konar. A, "Computational Intelligence: Principles, Techniques and Applications", Springer Verlag, 2005.

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Basics of Electronic Devices and Circuits

(Can be opted by students from all branches except ECE and the students who had undergone similar course as program core or program elective)

Course Code	OE EC 704
Course Title	Basics of Electronics Device and Circuits
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	10+2 Physics
Course Category	Open Elective (OE)
Number of classes	26 hours

Course Outcome:

After completion of the course, students will be able to:

CO Number	CO Description	K-level
CO-1	Understand the basic characteristics of semiconductor materials.	K2
CO-2	Explain the characteristics of PN junction and Zener diode.	K2
CO-3	Demonstrate the operation of Half wave, full wave, clipper, clampers, voltage regulator and voltage multiplier circuits.	K2
CO-4	Identify the transistor biasing, characteristics , and small signal model of BJT.	K2
CO-5	Explain the operation of MOSFET biasing, characteristics and MOSFEET amplifier.	K2

Course Content:

Module 1: Semiconductor Material and Diode (07 Hours.)

Semiconductor materials, covalent bond and intrinsic materials, energy levels, extrinsic materials: p-type and n-type semiconductors, PN Junction Diodes, Forward and Reverse Biasing, Reverse Saturation Current, Diode current components, Cut-in voltage, IV Characteristics., Zener diode, Light Emitting diode, Photodiode.

Module 2: Rectifier Circuits (06 Hours.)

Diode Load line Analysis, Series, Parallel and series-parallel Diode Configurations, Typical diode circuits, Half-wave & Full wave rectifier, Clippers, Clampers, Zener Diode as voltage regulators, Voltage multiplier circuits, Practical Applications of diode circuits.

Module 3: Transistors (07 Hours.)

Transistors, PNP and NPN transistors device structure and Operation, Transistor, Biasing, Amplifying action of a transistor, input and output characteristics of BJT, Small Signal Model of BJT.

Module 4: MOSFET(06 Hours.)

Field Effect Transistors, MOSFET-Enhancement and Depletion Modes, Regions of Operation.MOSFET Characteristics, MOSFET Biasing, MOSFET Amplifier, MOSFET as a switch.

***REFERENCE*:**

1. Integrated Electronics, Millman&Hailkias : TMH.
2. Electronic Devices And Circuits, Salivahanan, Kumar &Vallavaraj: TMH
3. Electronic Devices & Circuits, Boylestead&Neshelsky : PHI
4. Electronic Circuits , Discrete & Integrated, Schilling &Belove: TMH
5. Electronic Fundamentals & Applications, Chattopadhyay&Rakhshit, New Age
6. Microelectronic Circuits, Adel S. Sedra&Kennath C. Smith, OUP.

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NON-CONVENTIONAL ENERGY SYSTEMS

(Can be opted by students from all branches except EE and the students who had undergone similar course as program core or program elective)

Course Code	OE EE 704
Course Title	Non-Conventional Energy Systems
Number of Credits	2 (L: 2; T: 0; P: 0)
Prerequisites	NIL
Course Category	Open Elective (OE)
Number of Classes	26

Course Outcome: After Completion of this course students will able to

CO Number	CO Description	K-level
CO-1	Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.	K2
CO-2	Understand the basic physics of wind and solar power generation.	K2
CO-3	Apply the knowledge power electronic devices for wind and solar generation.	K3
CO-4	Understand the issues related to the grid-integration of solar and wind energy systems.	K2

Module – I Wind Power (6 hours.)

Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions. Wind generator topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators.

Module II Solar Power (8 hours.)

The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Solar photovoltaic: Technologies Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array.

Module III Traditional non-renewable resources of power (6 hours)

Need for accelerated growth: availability and environmental constraints of traditional non-renewable sources. Demerits of Solar sources. Technologies for electricity generation of Biomass; Tidal and Geothermal power plants. Ocean Thermal and Wave electricity generation. Fuel cells.

Module-IV Energy Storage (6 hours.)

Energy Storage: Role of Storage in electricity supply: Types and operation of Storage systems: (I) Chemical, (ii) Mechanical, (iii) Thermal, (iv) Magnetic Storage. Hydrogen energy. Energy Management and Audit: Demand Side and Supply Side of Management (DSM & SSM): Conservation of electrical energy, Technology & Potential Energy. Conservation Act, 2001. Energy Audit: Preliminary Detailed Audit.

References / Suggested Learning Resources:

1. T. Ackermann, “Wind Power in Power Systems”, John Wiley and Sons Ltd., 2005.
2. G. M. Masters, “Renewable and Efficient Electric Power Systems”, John Wiley and Sons, 2004.
3. S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.
4. H. Siegfried and R. Waddington, “Grid integration of wind energy conversion systems” John Wiley and Sons Ltd., 2006.
5. G. N. Tiwari and M. K. Ghosal, “Renewable Energy Applications”, Narosa Publications, 2004.
6. J. A. Duffie and W. A. Beckman, “Solar Engineering of Thermal Processes”, John Wiley & Sons.

Total Quality Management

(Can be opted by students from all branches except ME and the students who had undergone similar course as program core or program elective)

Course Code	OE ME 704
Course Title	Total Quality Management
Number of Credits	2 (L: 2, T:0, P: 0)
Prerequisites	NIL
Course Category	Open Elective (OE)
Number of classes	26 hours

Course Outcome:

After completing this course, the students will be able to

CO Number	CO Description	K Level
CO 1	Understand quality management philosophies, techniques, and frameworks	**K2**
CO 2	Analyze the understanding of TQM principles and processes	**K4**
CO 3	Apply tools and techniques of TQM in manufacturing and service sectors	**K3**
CO 4	Express knowledge about various aspects of quality and TQM	**K3**

Course Content:

Module 1: Introduction (6 Hours)

Need for quality, Definition of Quality, Evolution of quality, Product quality and Service quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs - Analysis, Techniques for Quality Costs, and Basic concepts of Total Quality Management.

Quality Council, Quality Statements, Strategic quality planning, Barriers to TQM Implementation, Benefits of TQM, Contributions of Deming, Juran and Crosby.

Module 2: TQM Principles (6 Hours)

Customer satisfaction- Customer Perception of Quality, Customer Complaints, Service Quality. Customer Retention; Employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous

process improvement; PDCA cycle, 5S, Kaizen; Supplier partnership, Partnering, Supplier rating & selection.

Module 3: TQM Tools and Techniques (10 Hours)

Benchmarking- Reasons to Benchmark, Benchmarking Process; Quality Function Deployment (QFD); Taguchi Quality Loss Function; Seven traditional tools of quality; New management tools; Process capability; Six sigma-concepts, methodology; TPM- concepts, improvement needs, performance measures; FMEA- Stages of FMEA.

Module 4: Quality Systems (4 Hours)

Need for ISO 9000 and Other Quality Systems, ISO 9001:2015 Quality System- Elements, Documentation; Quality Auditing, QS 9000, ISO 14000- Concept, Requirements and Benefits; TQM implementation in manufacturing and service sectors

Learning Resources:

1. D.H. Besterfield, C. Besterfield, G.H. Besterfield, M. Besterfield, H. Urdhwareshe and R. Urdhwareshe, Total Quality Management, Pearson Education, 2018.
2. A. Mitra, Fundamentals of Quality Control and Improvement, Wiley Student Edition, 2008.
3. S. Ramasamy, Total Quality Management, McGraw Hill Publishing Co., New Delhi, 2011.
4. J.R. Evans and W.M. Lindsay, The Management and Control of Quality, Cengage Learning,1999.
5. D.C. Montgomery, Introduction to Statistical Quality Control, John Wiley, 2019.
6. M.P. Poonia, Total Quality Management, Khanna Book Publishing, 2018.

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Building Construction Practice

(Can be opted by students from all branches except CE&CA and the students who had undergone similar course as program core or program elective)

Course Code	OE CC 704
Course Title	Building Construction Practice
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	Nil
Course Category	Open Elective (OE)
Number of classes	26 hours

Course Outcomes: After completion of the course students will be able to-

CO No	CO Description	K-level
CO-1	Explain different components and classification of building	K-2
CO-2	Illustrate sequence of activities of building construction	K-2
CO-3	Demonstrate different Sub Structure Construction	K-4
CO-4	Design Green Buildings	K-6

Course contents:-

Module 1: **- (6 hours)**

Types of buildings, components of a building , details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry –Brick masonry- Bond in masonry - concrete hollow block masonry – flooring – damp proof courses –cavity walls-partition walls- construction joints – movement and expansion joints .

Module 2: **- (6 hours)**

Building foundations-types – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof and roof coverings, finishes;

Module 3: **- (6 hours)**

Sub Structure Construction- Techniques of Box jacking – Pipe Jacking –under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by

Module 4: **- (8 hours)**

Green Buildings: Importance, components: Site, Rain water harvesting/water efficiency, energy efficiency, material efficiency Indoor air quality design and innovation rating system.

Ventilation: functional requirement, system, natural ventilation, mechanical ventilation, air conditioning.

Text/Reference Books:

1. Rangwala, Engineering Materials, Charotar Publishing House Pvt. Ltd.
2. Ashok Kumar Jain, Dr. B.C. Punmia, Arun Kumar Jain, Building Construction, Laxmi Publications Pvt. Ltd.
3. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann
4. S.K.Duggal, Building Materials, 3rd Edition, New Age International Publishers.
5. Sushil Kumar, Building Construction, Standard Publishers Distributors.
6. M.S.Shetty, Concrete Technology: Theory and Practice, S. Chand Publishers.

Real Time Embedded Systems

(Can be opted by students from all branches except ECSE and the students who had undergone similar course as program core or program elective)

Course Code	OE ES 704
Course Title	Real Time Embedded Systems
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	Basic understanding of electronic devices and circuits ; Basic C programming
Course Category	Open Elective.
Number of classes	26 hours.

Course Outcome:

CO Number	CO Description	K-level
CO-1	Construction and optimization of Embedded systems hardware.	K2
CO-2	Construction of Embedded and Real time Operating System.	K2
CO-3	Implementation of Embedded C for hardware realization.	K3
CO-4	Synthesis of Embedded System using design case studies.	K4

Module 1: Embedded Systems Design (08 Hours)

Introduction to Embedded System, ASICs and ASIPs ; Introduction to FPGAs and Synthesis ; Designing Single Purpose Processors and Optimization ;Microcontrollers and Power Aware Embedded System Design; Fundamentals of Physical Interfacing: Connecting Input and Output devices; Advanced Physical Interfacing: Driving load - high side, low side and H-bridge, Multiplexing displays including Charlieplexing, Shaft encoder; Embedded Design using Verilog HDL.

Module 2: Embedded / Real Time/Operating System (06 Hours)

Architecture of kernel, Task and Task scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes, Message queues, Event registers, Pipes, Signals, Timers, Memory management, Priority inversion problem. Off-the-Shelf Operating Systems, Embedded Operating Systems, Real Time Operating System (RTOS) and Handheld Operating Systems ; Real Time Scheduling Algorithms ; Modeling and Specification ; Hardware Software Partitioning ; Design Optimization ; Simulation and Verification

Module 3: Embedded C (06 Hours)

Structure of a C Program. Identifiers, Name Spaces and Scope, Compilation & Linking , Variables .Functions,Representing Numbers , Types .Operators , Bit Manipulation , Modulus and Shifting. For and While Loops , If and Switch statements ,Arrays , Multidimensional Arrays , Strings , Overview of Structures.

Module 4: Embedded System: Design case studies (06 Hours)

Digital clock, Battery operated smart card reader, Automated meter reading system, Digital camera, moore and mealy vending machine, stepper motor design using embedded system.

Reference:

1. Introduction to embedded systems, Shibu K. V., McGraw Hill
2. Embedded / real – time systems: concepts, design & programming, Black Book, Dr. K. V. K. K.Prasad, Dreamtech press, Reprint edition 2013
3. Embedded systems an integrated approach, Laya B. Das, Pearson, Third impression, 2013
4. Embedded system design A Unified hardware/software Introduction, Frank Vahid, Tony Givargis, Wiely .
5. Embedded C. Michael J. Pont. An imprint of Pearson Education.
6. Embedded Software Development With C. by Haring D.D. Et.Al , Kai , Qian.

Automobile Engineering

(Can be opted by students from all branches except AMIA and the students who had undergone similar course as program core or program elective)

Course Code	OE MI 704
Course Title	Automobile Engineering
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	10+2 Physics, Kinematics of Machine
Course Category	Open Elective (OE)
Number of classes	26 hours

Course Outcome: After successful completion of this course, a student will be able to-

CO No	CO Description	K-level
CO-1	Identify various parts of automobile engine and their activities and method and materials used to manufacture them.	K-1
CO-2	Diagnose problems related to automotive transmission system along with drive line and rear axle.	K-3
CO-3	Diagnose problems related to the steering system.	K-3
CO-4	Diagnose problems related to the automotive electrical system.	K-3
CO-5	Diagnose problems related to the suspension system applied in automobile vehicle.	K-3

Course content:-

Module 1: (6 Hours)

Vehicle Structure and Engines-Types of Automobiles, Vehicle Construction – Chassis, Frame and Body. Components of Engine – Their forms, Functions and Materials, Review of Cooling and Lubrication systems in Engine, Turbo Chargers, Engine Emission Control by 3–Way Catalytic Controller, Electronic Engine Management System.

Module 2: (6 Hours)

Engine Auxiliary Systems: Carburetor–working principle, Electronic fuel injection system – Mono-point and Multi - Point Injection Systems, Electrical systems – Battery generator – Starting Motor and Drives – Lighting and Ignition (Battery, Magneto Coil and Electronic Type) - Regulators-cut outs

Module 3: (6 Hours)

Transmission Systems: Clutch – Types and Construction, Gear Boxes-Manual and Automatic, Simple Floor Mounted Shift Mechanism, Over Drives, Transfer Box Fluid flywheel-Torque

convertors, Propeller shaft – Slip Joint – Universal Joints, Differential and Rear Axle, Hotchkiss Drive and Torque Tube Drive.

Module 4: **(8 Hours)**

Steering, Brakes and Suspension: Wheels and Tires – Wheel Alignment Parameters, Steering Geometry and Types of steering gear box, Power Steering, Types of Front Axle – Suspension systems. Braking Systems – types and construction – Diagonal Braking System – Antilock Braking System.

Alternative Energy Sources-Use of Natural Gas, LPG and Biodiesel in Automobiles, Electric and Hybrid Vehicles, Fuel Cells.

Text/Reference Books:

1. Crolla, D., Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann.

2. Heisler, H., Advanced Vehicle Technology, Butterworth-Heinemann.

3. Happian-Smith, J., An Introduction to Modern Vehicle Design, Butterworth- Heinemann.

4. Newton, Steeds and Garet, Motor vehicles, Butterworth Publishers.

5. Crouse, W. H., & Anglin, D. L., Automotive Mechanics: Study Guide, McGraw