M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Mechanical Engineering)

SEMESTER 7th AND 8th

Scheme effective from 2021-22

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
OEC	Open Elective Courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical
PROJ	Project

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.

2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.

3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding

for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

Scheme of Studies and Examination B.TECH (Mechanical Engineering) – 7th Semester

w.e.f. 2021-22 (Scheme-G)

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	Theory	Practical	Total	
1.	Professional Elective Courses		Professional Elective Courses(PEC): Refer List-II	3	0	0	3	3	25	75		100	3
2.	Professional Core Courses	PCC-ME-401G	Design of Machine Element-II	3	0	0	3	3	25	75		100	3
3.	Professional Core Courses	PCC-ME-403G	Entrepreneurship Development	3	0	0	3	3	25	75		100	3
4.	Professional Elective Courses		Professional Elective Courses(PEC): Refer List-III	3	0	0	3	3	25	75		100	3
5.	Practical	LC- ME-403G	Workshop Lab-III	0	0	2	2	1	25		25	50	3
6.	Seminar	PCC-ME-405G	Seminar	0	0	2	2	1	25		25	50	3
7.	Project	PROJ-ME-407G	Project-I	0	0	9	9	4.5	25		25	50	3
8.	Practical Training	PT-ME-409G	Practical Training-II	0	0	2	2	Refer Note:1 (Grading)					
9.	Mandatory courses (non-credit)	MC-317G	Constitution of India	2	0	0	2	Refer Note:2 (Grading)					
TOTAL								**18.5**	**175**	**300**	**75**	**550**	

Note: 1. The evaluation of Practical Training-II(PT-ME-409G) will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat .

Practical Training. Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Note: 2 The students will be awarded grades A, B, C & F in Evaluation of Constitution of India. A student who is awarded 'F' grade is required to repeat.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

3.Choose any one subject from Professional Elective Courses(PEC) (Semester-VII) LIST-II

4. Choose any one from subject from Professional Elective Courses(PEC) List III

PROFESSIONAL ELECTIVE COURSES(PEC) (Semester-VII) LIST-II

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-401G	Refrigeration & Air Conditioning	3	3
2.	PEC-ME-403G	Project Management	3	3
3.	PEC-ME-405G	Numeric Control of Machine Tools and Robotics	3	3
4.	PEC-ME-407G	Finite Element Analysis	3	3

Note: Students will have to select any one out of the list.

PROFESSIONAL ELECTIVE COURSES(PEC) (Semester-VII) LIST-III

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-409G	Noise and Vibrations	3	3
2.	PEC-ME-411G	Solar Energy Engineering	3	3
3.	PEC-ME-413G	Tribology	3	3
4.	PEC-ME-415G	Composite Materials	3	3

Note: Students will have to select any one out of the list.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

Scheme of Studies and Examination B.TECH (Mechanical Engineering) – 8th Semester

w.e.f. 2021-22(Scheme-G)

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	Theory	Practical	Total	
1.	Professional Core Courses	PCC-ME-402G	Industrial Automation	3	0	0	3	3	25	75		100	3
2.	Professional Elective Courses		Professional Elective Courses(PEC): Refer List-IV	3	0	0	3	3	25	75		100	3
3.	Professional Elective Courses		Professional Elective Courses(PEC): Refer List-V	3	0	0	3	3	25	75		100	3
4.	Professional Elective Courses		Professional Elective Courses(PEC): Refer List-VI	3	0	0	3	3	25	75		100	3
5.	Open Elective Courses(OEC)/ Humanities And Social Sciences Including Management Courses (HSMC)-List-III	OEC/HSMC-III	Refer OEC List-III	3	0	0	3	3	25	75		100	3
6.	Practical	LC- ME-404G	Workshop Lab-IV	0	0	2	2	1	25		25	50	3
7.	Seminar	PCC-ME-406G	Seminar	0	0	2	2	1	25		25	50	3
8.	Project	PROJ-ME-408G	Project-II	0	0	10	10	5	75		75	150	3
		TOTAL						**22**	**250**	**375**	**125**	**750**	

1.Choose any one subject from Professional Elective Courses(PEC) (Semester-VIII) LIST-IV

2.Choose any one subject from Professional Elective Courses(PEC) (Semester-VIII LIST-V

3.Choose any one subject from Professional Elective Courses(PEC) (Semester-VIII LIST-VI.

4.Choose any one subject from Open Elective Courses(OEC)/ Humanities and Social Sciences Including Management Courses (HSMC)- (Semester VIII)-LIST-III

PROFESSIONAL E ELECTIVE COURSES(PEC) (Semester-VIII) LIST-IV

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-402G	Tool Design	3	3
2.	PEC-ME-404G	Plant Maintenance Engg.	3	3
3.	PEC-ME-406G	Design and Optimization of Thermal Energy Systems	3	3
4.	PEC-ME-408G	Gas Dynamics and Jet Propulsion	3	3

Note: Students will have to select any one out of the list.

PROFESSIONAL ELECTIVE COURSES(PEC) (Semester- VIII) LIST-V

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-412G	Power Plant Engineering	3	3
2.	PEC-ME-414G	Product Design and Development	3	3
3.	PEC-ME-416G	Non Conventional Energy Resources Utilization	3	3
4.	PEC-ME-418G	Introduction to Nanoscience and Nanotechnology	3	3

Note: Students will have to select any one out of the list.

PROFESSIONAL ELECTIVE COURSES(PEC) (Semester-VIII) LIST-VI

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-420G	Automobile Engineering	3	3
2.	PEC-ME-422G	Design of Transmission Systems	3	3
3.	PEC-ME-424G	Alternate Fuels and Energy Systems	3	3
4.	PEC-ME-426G	Optimisation for Engineering Design	3	3

Note: Students will have to select any one out of the list.

OPEN ELECTIVE COURSES(OEC)/ HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)-LIST-III

Students have to select any one Open Elective Course-I from the list of courses.

List-III (Semester VIII)

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	OEC –ME-402G	Operation Research	3	3
2.	OEC –ME-410G	Quality Engineering	3	3
3.	OEC –EE-412G	Electrical Power Generation	3	3
4.	OEC-CSE-430G	Computer Communication	3	3
5.	OEC-CE- 448G	Traffic Engineering and Road Safety	3	3
6.	OEC-CE- 450G	Disaster Management	3	3
7.	OEC –ECE-453G	Microprocessor Application in Automobiles Sector	3	3
8.	HSMC-10G	Management Information Systems	3	3

Note: Students will have to select any one out of the list.

Course code	**PCC-ME-401G**				
Category	Professional Core Courses				
Course title	**Design of Machine Element-II**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	To understand the Design for Production and for variable loading. Impart in depth knowledge of designing of screws and different types of fasteners. How to design bearings, selection of bearings for different aspects & lubricants with their properties. Knowledge of gears, design of different types of gears with consideration of maximum power transmission and gear lubrication. Learn in depth knowledge of flywheels and their design.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note:1. Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Design for Production ; Erogonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining.

Variable Loading : Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.

UNIT-II

Shafts: Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.

Springs: Types of Springs, Design for helical springs against tension and their uses, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs, Design Problem.

UNIT-III

Bearings : design of pivot and collar bearing , Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of Bearings from manufacturer's catalogue, types of lubrication – Boundary, mixed and hydrodynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.

UNIT-IV

Gears : Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth, Dynamic load on gear teeth -Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Expose the students to the Design for Production and for variable loading.

CO 2- Impart in depth knowledge of designing of screws and different types of fasteners.

CO 3- Design bearings, selection of bearings for different aspects & lubricants with their properties.

CO 4- Knowledge of gears, design of different types of gears with consideration of maximum power transmission and gear lubrication.

CO 5- Learn in depth knowledge of flywheels and their design.

Note:

The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:

(i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan

(ii) Design Data Book PSG College of Technology Coimbatore

Text Books:

1. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

Reference Books :

1. Engineering design – George Dieter, McGraw Hill, New York.
2. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.

3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition –Addison Wisley Longman 8. Machine Design : S.G. Kulkarni , TMH , New Delhi.

Course code	**PCC-ME-403G**				
Category	Professional Core Courses				
Course title	**Entrepreneurship Development**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	To familiarize the students with the basics of Entrepreneurship Development.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Entrepreneurship : Concept and Definitions; Entrepreneurship and Economic Development; Types of Entrepreneurs; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Manager Vs. Entrepreneur, types of entrepreneurships, Entrepreneurial myths.

UNIT-II

Opportunity Identification and Product Selection: Entrepreneurial Opportunity Search & Identification;Criteria to Select a Product; Conducting Feasibility Studies; Sources of business ideas, launching a new product; export marketing, Methods of Project Appraisal, Project Report Preparation; Project Planning and Scheduling. Sources of finance for entrepreneurs.

UNIT-III

Small Enterprises and Enterprise Launching Formalities : Definition of Small Scale; Rationale; Objective;Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection , Role of SSI in Economic Development of India; major problem faced by SSI,MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes.

UNIT-IV

Role of Support Institutions and Management of Small Business : Director of Industries; DIC; SIDO;SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Venture

Capital : Concept, venture capital financing schemes offered by various financial institutions in India, Legal issues – Forming business entity, considerations and criteria, requirements for formation of a Private/Public Limited Company,

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Students will be able understand who the entrepreneurs are and what competences needed

CO2 - Students will be able to understand insights into the management, opportunity search, identification of a product, market flexibility studies, project finalization etc. required for small business enterprise.

CO3- Students will be able to write a report and do oral presentation on the topics such as product identification, business ideas, export marketing etc.

CO4 - Students will be able to know the different financial and other assistance available for establishing small industrial units.

Text Books & Reference Books :

1. "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
2. Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
3. "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
4. "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
5. Enterpreneurship Development- S.Chand&Co.,Delhi- S.S.Khanka 1999
6. Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
7. Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.
8. Entrepreneurship Ideas in Action- L. Greene, Thomson Asia Pvt. Ltd., Singapore, 2004.

Course code	**PEC-ME-401G**				
Category	Professional Elective Courses (PEC)) **(Semester-VII) LIST-II**				
Course title	**REFRIGERATION & AIR CONDITIONING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	1. To familiarize with the terminology associated with refrigeration systems and air conditioning 2. To understand basic refrigeration processes 3. To understand the basics of psychrometry and practice of applied psychrometrics . 4. To acquire the skills required to model, analyse and design different refrigeration as well as air conditioning processes and components				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Definition of refrigeration & air conditioning; Necessity; Methods of refrigeration; Unit of refrigeration; Coefficient of performance (COP), Fundamentals of air-conditioning system; Refrigerants-Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendly Refrigerants; Introduction to Cryogenics.

Air Refrigeration System: Carnot refrigeration cycle. Temperature. Limitations; Brayton refrigeration or the Bell Coleman air refrigeration cycle; Necessity of cooling the aero plane; Air craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, Comparison of different systems, problems.

UNIT-II

Vapour Compression (VC) Refrigeration Systems: (A) Simple Vapour Compression (VC) Refrigeration systems-Limitations of Reversed Carnot cycle with vapour as the refrigerant; Analysis of VC cycle considering degrees of

sub cooling and superheating; VC cycle on p-v, t-s and p-h diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle.

Multistage Ref. Systems- Necessity of compound compression, Compound VC cycle , Inter-cooling with liquid sub –cooling and / or water inter cooler: Multistage compression with flash inter-cooling and / or water inter-cooling; systems with individual or multiple expansion valves; Individual compression system with individual or multiple expansion valves; Individual compression systems with individual or multiple expansion valves but with and without intercoolers.

Other Refrigeration Systems: (A) Vapour Absorption Refrigeration Systems – Basic Systems, Actual COP of the System, Performance, Relative merits and demerits; Properties of aqua ammonia; Electrolux Refrigeration; Problems. Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits, Performance Applications, Problems.

UNIT-III

Psychrometry of Air & Air Conditioning Processes: Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychrometric chart; Psychrometry of air-conditioning processes, Mixing Process, Basic processes in conditioning of air; Psychrometric processes in air washer, Problems.

Air- Conditioning Load Calculations: Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure, Solar radiation, Electrical applications, Infiltration and ventilation, Heat generation inside conditioned space; Apparatus selection; Comfort chart, Problems.

UNIT-IV

Air Conditioning Systems with Controls & Accessories: Classifications, Layout of plants; Equipment selection; Air distribution system; Duct systems Design; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Temperature sensors, Pressure sensors, Humidity sensors, Actuators, Safety controls; Accessories; Problems.

Refrigeration and Air Conditioning Equipments: Type of compressors and their performance curves; Types of Condensers, Heat transfer in condensers; Types of expansion devices; types of evaporators, Cooling and Dehumidifying coils, Problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the air refrigeration, vapour compression refrigeration, vapour absorption, steam jet refrigeration systems and different type of refrigerants.

CO 2- Expedite the working of single stage, multistage and cascade refrigeration.

CO 3- Knowledge of psychrometry and different psychrometric processes. Understand and evaluate cooling and heating load and design of HVAC system.

CO 4- Develop and design RAC systems and evaluate different expansion and control devices.

Text Books :

1. Refrigeration & Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall of India. .
2. Refrigeration & Air conditioning –C.P. Arora, TMH, New Delhi.

Reference Books:

1. A course in Refrigeration & Air Conditioning – Arora & Domkundwar, Dhanpat Rai & Sons.
2. Refrigeration & Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.
3. Refrigeration & Air conditioning- Manohar Prasad Wiley Estern limited, New Delhi.

Course code	**PEC-ME-403G**				
Category	Professional Elective Courses (PEC)) **(Semester-VII) LIST-II**				
Course title	**PROJECT MANAGEMENT**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	The students completing this course are expected to understand the concepts of Project Management, how it work.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Project Management :Project Management Concepts, Project Planning, Resource Scheduling, Critical Chain Scheduling, Project Quality Management, Project performance Measurement and Control, Project Closure/ Termination, Managing Project Teams, IT in Projects, International Projects: Issues in managing international projects, Selection and training of employees, cross cultural considerations.

UNIT-II

Theory & Background : Definitions, hard & soft projects, multi project management, program management , project phases, project control project groups. Go/no go decisions.

Idea Phase : Idea selction, development of project contract, determination of project organization, development of project order.

UNIT-III

Defintion Phase : Phase steps : Project description, project results, work breakdown structure, Input management, Project leader ship.

Planning Phase : Development of responsibility matrix, detail project planning, risk & change analysis, arranging input.

UNIT-IV

Implementation Phase : Project monitoring & control, project adjustment, dealing with people.

Implementation & After Care : Evaluation and closure of a project.

Course Outcomes (COs): At the end of the course, the student shall be able to: They properly understand the concepts of Project Management, how it work.

Reference Books:

1. Project Management handbook, Cleland , D.I. and W.R. King, USA.
2. Project Management Body of Knoweldge (PMBOK), Project.
3. Handbook for project oriented organization, Rath S. Hoogland, R. and Turner, J.R.
4. Clifford F Gray, Erik W Larson, "Project Management-The Managerial Process", Tata Mcgraw-Hill Publishing Co Ltd
5. Jack Meredith, Samuel J. Mantel Jr. "Project Management- A Managerial Approach", John Wiley and Sons
6. John M Nicholas "Project Management For Business And Technology" Prentice Hall of India Pvt Ltd
7. James P Lewis "Project Planning, Scheduling And Control" Tata Mcgraw-Hill Publishing Co Ltd.

Course code	**PEC-ME-405G**				
Category	Professional Elective Courses (PEC)) **(Semester-VII) LIST-II**				
Course title	**NUMERIC CONTROL OF MACHINE TOOLS AND ROBOTICS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	The students completing this course are expected to understand the basic knowledge of machine tools and robotics and also automation concepts.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fundamentals of Numerical Control: Introduction to numerical control, Classification of NC/CNC machines and axis nomenclature, PTP and Continuous Contouring, Absolute and Incremental Programming, Difference between NC and CNC, Different types of software's in CNC.

Control system fundamentals: feedback, transfer function, system stability. Open Loop and Closed Loop control: Servo Mechanism, Position and Velocity feedback.

Engineering Analysis of NC/CNC systems: Computations of total number of pulses and pulse frequency in Open Loop and Closed Loop control, Precision in NC/CNC: Resolution, Accuracy and Repeatability.

Interpolation in NC and CNC: Linear and Circular, Tolerance Analysis: Inward, Outward and Secantial. System components: Machine Control Unit (MCU), Transducers, Actuators.

UNIT-II

Design considerations of NC/CNC machine tools: Re-circulating ball screw, lost motions in NC systems, Turning Centers and Machining Centers.

Part Programming: Manual programming: Different G codes and M codes, Stock Removal Cycle, Canned Cycles. Computer assisted Part Programming. Tool path generation from CAD models, CNC Toolings.

Process optimization: Online condition monitoring in CNC,

Adaptive control: ACC, ACO & GA. DNC: Direct and Distributed Numerical Control, Merits of DNC, Concept of BTR, Data Multiplexing.

UNIT-III

Automation & Robotics; Spatial Descriptions & Transformations, Manipulator Kinematics – Forward and Inverse; Jacobians: Velocities & Static Forces. Robot Arm Dynamics: Lagrange-Euler formulation of manipulator dynamics. Trajectory Planning: Joint-interpolated trajectories, Geometric problems with Cartesian paths, Collision-free path planning. Robot Control Systems: Feedback and Closed-loop control, Transfer Functions, Control of Second-order systems, Non-linear & time varying systems, Adaptive.

UNIT-IV

Robotic Prehension**:** Dexterous manipulation; ANN approach in prehension, Sensors in Robotics: Machine vision, Force & Torque sensors. Robot programming: simulators and languages, Tele-robotics and virtual interfaces for task specification and programming, Concept of nanorobotics, Performance analysis of industrial robots and their manufacturing applications, Economics of robotics, Social issues & future of robotics.

Course Outcomes (COs): At the end of the course, the student shall be able to: They properly understand the concepts of basic knowledge of machine tools and robotics and also automation concepts.

Text Book:

1. Robotics for Engineers by Y. Koren, McGraw Hill New York
2. Robotics Technology and Flexible Automation by S.R.Deb, TMH.
2. Numerical Control and Computer Aided manufacturing by R. S. Pressman & J. E. Williams, John Wiley & Sons
3. Computational Geometry for Design and Manufacture, by I. D. Faux and M. J. Pratt, Ellis Horwood, Chichester, 1979.
4. Numerical Control in Manufacturing by F. W. Wilson, McGraw-Hill Book Company New York.
5. Mittal R. K. &Nagrath I. J., "Robotics and Control", TMH, 2003 (Reprint 2007 or later).
6. Groover, M. P., et al., "Industrial Robotics", MGHISE, 1986
7. Computer Control of Manufacturing Systems by Y. Koren, McGraw-Hill
8. Industrial Robotic Technology - Programming and Application by M.P.Groover et. al., McGrawHill
9. Robotics: Control, Sensing, Vision and Intelligence by Fu, Lee and Gonzalez, McGraw Hill New York.

Course code	**PEC-ME-407G**				
Category	Professional Elective Courses (PEC) **(Semester-VII) LIST-II**				
Course title	**FINITE ELEMENT ANALYSIS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	1. To illustrate the principle of mathematical modeling of engineering problems 2. To introduce the basics and application of Finite Element Method.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basic concept of Finite Element Method.

UNIT-II

One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, solution of problems from solid mechanics and heat transfer, longitudinal vibration and mode shapes, fourth order beam equation, transverse deflections and natural frequencies.

UNIT-III

Two dimensional equations, variational formulation, finite element formulation, triangular elements- shape functions, elemental matrices and RHS vectors; application to thermal problems, torsion of non-circular shafts, quadrilateral and higher order elements. Plane stresses and plane strain problems, body forces and thermal loads, plate and shell elements.

UNIT-IV

Natural coordinate systems, isoparametric elements and shape functions, numerical integration and application to plane stress problems, matrix solution techniques, solution of dynamic problems, introduction to FE software.

Course Outcomes: Upon completion of the course, students will understand the FEM formulation and its application to simple structural and thermal problems

Text Books:

1. Reddy J.N., An Introduction to Finite Element Method, 3rd ed., Tata McGraw Hill, 2005.

2. Seshu P., Text Book of Finite Element Analysis, Prentice Hall, New Delhi, 2007.

3. Rao S.S., The Finite Element Method in Engineering, 3rd ed., Butterworth Heinemann, 2004.

4. Chandraputla&Belegundu, Introduction to Finite Elements in Engineering, 3rd ed., Prentice Hall, 1990.

Course code	**PEC-ME-409G**				
Category	**PROFESSIONAL ELECTIVE COURSES(PEC)** (Semester-VII) LIST-III				
Course title	**NOISE AND VIBRATIONS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	CO1 - Understand the fundamentals of mechanical vibrations leading to analysis of first degree of freedom CO2 - To introduce the basics concept of two degree of vibration and vibration isolation and transmissibility CO3 - Analyse experimental methods for vibration analysis. CO4 –To learn the influence and stiffness coefficients. CO5 - Analyse the concept of the non-linearity in vibrations and also concept of noise.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fundamentals : Importance of Study of Vibrations, Classifications of Vibrations, Free and Forced, Undamped and Damped, Linear and Non-linear, Deterministic and Random, Harmonic Motion, Vector and Complex Number Representations, Definitions and Terminology, Periodic Functions, Harmonic Analysis, Fourier Series Expansion.

Free and Damped Vibrations : Single Degree of Freedom system, D'Alemberts Principal, Energy Methods, Rayleighs Method, Application of these Methods, Damped Free Vibrations, Logarithmic Decrement, Under Damping, Critical and Over Damping, Coulomb Damping.

UNIT-II

Harmonically Excited Vibrations : Forced Damped Harmonic Vibration of Single Degree of Freedom Systems, Rotating Unbalance, Rotor Unbalance, Critical Speeds and Whirling of Rotating Shafts, Support Motion, Vibration Isolation, Energy Dissipated by Damping, Equivalent, Viscous Camping, Structural Damping Sharpness of Resonance, Vibration Measuring Instruments.

Transient Vibrations : Impulse Excitation, Arbitrary Excitation, Response to Step Excitions, Base Excitation Solution by Laplace Transforms, Response Spectrum, Runge-Kutta Method.

UNIT-III

Two Degrees of Freedom Systems : Introduction to Multi-Degree of Freedom Systems, Normal Mode Vibrations, Coordinate Coupling, Principal Coordinates, Free Vibrations in Terms of Initial Conditions, Forced Harmonic Vibrations, Vibration Absorber, Centrifugal Vibration Absorber, Vibration Damper.

Multi degrees of Freedom Systems and Numerical Methods Introduction, Influence Coefficients, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes, Orthogonality of Normal Modes, Dunkerley's Equation, Method of Matrix Iteration, The Holzer Type Problem, Geared and Branched Systems, Beams.

UNIT-IV

Normal Mode Vibration of Continuous System: Vibrating String, Longitudinal Vibrations of Rod, Torsional Vibrations of Rod, Lateral Vibrations of Beam.

Noise**:** Noise characteristics, Sources of noise, noise level measurement techniques, vehicular noise level, engine noise, transmission noise, brake squeal, structural noise, noise in auxiliaries, wind noises etc.

Noise Testing & Noise Control:Mechanization of noise generation, noise control methodologies, noise control measures, environmental noise management. Road vehicle noise standards .

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Understand the fundamentals of mechanical vibrations leading to analysis of first degree of freedom

CO2 - To understand the concept of two degree of vibration and vibration isolation and transmissibility

CO3 - Analyse experimental methods for vibration analysis.

CO4 - Understanding the influence and stiffness coefficients.

CO5 - Analyse the concept of the non-linearity in vibrations and also concept of noise.

Text Books :

1. Theory of Vibrations with Applications W.T. Thomson, Prentice Hall of India.
2. Mechanical Vibration : G.K. Grover and S.P. Nigam, Nem Chand and Sons
3. Noise, Pollution & Control – S. P. Singal, Narosa Publishing House, New Delhi

Reference Books :

1. Theory and Practice of Mechanical Vibrations J.S. Rao and K. Gupta, Wiley Eastern Ltd.
2. Mechanical Vibrations S.S. Rao, Addison – Wesely Publishing Company.

Course code	**PEC-ME-411G**				
Category	**Professional Elective Courses** (Semester-VII) (List-III)				
Course title	**SOLAR ENERGY ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	To provide an overview of solar system and the associated energy conversion issues.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Solar Radiation: Introduction, solar system – sun, earth and earth-sun angles, time, derived solar angles, estimation of solar radiation (direct and diffuse), measurement systems – phyrheliometers and other devices. Effect of Solar radiation upon structures: Steady state heat transmission, solar radiation properties of surfaces, shading of surfaces, periodic heat transfer through walls and roofs.

UNIT-II

Solar Collectors: Flat plate and concentrating – comparative study, design and materials, efficiency, selective coatings, heliostats. Heating Applications of Solar Energy: Air and Water heating systems, thermal storages, solar bonds, solar pumps, solar lighting systems, solar cookers, solar drying of grains.

UNIT-III

Cooling Applications of Solar Systems: Continuous and Intermittent vapour absorption systems for cooling applications, absorbent – refrigerant combination, passive cooling systems.

UNIT-IV

Solar Electric Conversion Systems: Photovoltaics, solar cells, satellite solar power systems. Effects on Environment, economic scenario, ozone layer depletion, green house effect, global warming, Remedial measures by international bodies.

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Understand the concept and principles of solar system.

CO2 - Utility and applications of solar system and the associated with energy conversion issues.

Text Books:

1. Solar Energy – S P Sukhatme, Tata McGraw Hill
2. Solar Energy Process – Duffie and Bechman, John Wiley

References Books:

1. Applied Solar Energy – Maniel and Maniel, Addison Wiley
2. Solar Energy: Fundamentals and Applications – R P Garg and Jai Prakash, TMH.

Course code	**PEC-ME-413G**				
Category	**PROFESSIONAL ELECTIVE COURSES(PEC)** (Semester-VII) LIST-III				
Course title	**TRIBOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	The students completing this course are expected to understand the basic concept of tribology and use of engine, wear, friction .				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

.3

UNIT-I

Introduction: Introduction of Tribology – General tribological considerations in the design of bearings, gears, cams, reciprocating components, etc.

Engine tribology basics - tribology / aspects of engine components such as bearings, piston assembly, valve train and drive train components etc.

UNIT-II

Friction: Natural of metal surfaces – Surface properties – Surface parameters and measurements. Friction – Sliding friction – Rolling friction characteristics of common metals and non-metals – friction under environments. Engine friction – Losses and engine design parameters.

Wear: Economic role of wear – type of wear- wear mechanism, factors affecting wear, selection of materials for different wear situations, measurement of wear, tribometers and tribometry. Engine wear, mechanisms, wear resistance material and coatings and failure mode analysis.

Bearings and Lubrication: Lubricants, type of lubricants, properties and testing, service classification of lubricants, lubrication of tribological components, lubrication system, lubricant monitoring, SOAP, ferrography and other rapid testing methods for lubricants contamination.

UNIT-III

Hydrodynamic Lubrication: Theory of hydrodynamic lubrication, generalized Reynolds equation, slider bearings, fixed & pivoted shoe bearings, hydrodynamic journals bearings, short and finite bearings, thrust bearings, sintered bearing, non-circular bearings and multi side surface bearings.

Externally (Externally – pressurized) lubrication: Hydrostatic bearing, basic concepts, bearing pads, coefficients, restrictors, capillary, orifice and flow control valve, bearing characteristics number and performance coefficients, flat, conical and spherical pad thrust bearing, multi-recess journal and thrust bearings, air and gas lubricated bearings.

UNIT-IV

Elasto – hydrodynamic lubrication: Ball and roller element bearings, classification, selection and life estimation, fatigue, monitoring of ball / roller bearings, diagnostics.

Rheodynamics (Static) lubrication: Non-Newtonian fluids, characteristics, general recommendations of lubricants, SAE & other cloud numbers, thixotopic, materials and Bingham solids, grease lubrication and care stability, tribology components in extreme environments like vacuum, pressure, temperature, tribology matching and selection, tribolo-testing and standards.

Course Outcomes (CO'S): Students would be able : CO1 - To understand about the basic concept of tribology and use of engine, wear, friction .

Reference Books:

1. Friction and Lubrication, Bowden F.P. & Tabor D., Heinemann Edu. Books Ltd. 1974
2. Friction & Wear of Material, Ernest Rabinowiez
3. Tribology – Handbook, Neal M.J., Butterworth, 1973
4. Standard hand Book of Lubrication Engg., O'Connor J.J. & Boyd J., McGraw Hill, 1968.
5. Theory of Hydro-dynamic Lubrication, Pinkus O, & Sternlincht B., McGraw Hill, 1961.
6. Theory & Practice of Lubrication of Bearing, Fuller D.D., McGraw Hill, 1947. 7. Analysis & Lubrication of Bearings, Shaw M. C., Macks F., McGraw Hill, 1947.

Course code	**PEC-ME-415G**				
Category	**PROFESSIONAL ELECTIVE COURSES(PEC)** (Semester-VII) LIST-III				
Course title	**COMPOSITE MATERIALS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	1. To understand the mechanical behaviour of composite materials 2. To get an overview of the methods of manufacturing composite materials and their fabrication methods and testing.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke;s law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.

Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes .

UNIT-II

Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, TsaiHill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies

UNIT-III

Fabrication methods: Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression molding, resin-transplant method, pltrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films

UNIT-IV

Testing of Composites: Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc.

Course Outcomes (CO'S): Upon completion of this course, the students will have an overview of the mechanical behaviour and application of composite materials and their fabrication methods and testing.

Text Books:

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill, 1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill, 1998
3. Materials characterization, Vol. 10, ASM hand book
4. Mechanical Metallurgy by G. Dieter Mc-Graw Hill
5. Thermal Analysis of Materials by R.F. Speyer, Marcel Decker
6. Engineering Materials: Polymers, Ceramics and Composites A.K Bhargava Prentice Hall India

Course code	**LC- ME-403G**				
Category	Professional Core Courses				
Course title	**Workshop Lab-III**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	0	0	2	1	
Objectives:	Understand the vapour compression refrigeration system and vapour absorption system. Application of different compressors used in refrigeration system. Understand functioning of various control devices Evaluate the COP of various refrigeration system such as vapour compression refrigeration system and vapour absorption system. Knowledge of how the loading condition changes the COP of the system.				
Internal Practical Class Marks	25 Marks				
External Practical Class Marks	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments : (Refrigeration & Air Conditioning Lab)

1) To study the vapour compression Refrigeration System and determine its C.O.P. and draw P-H and T-S diagrams.
2) To Study the Mechanical heat pump and find its C.O.P.
3) To study the Air and Water heat pump and find its C.O.P.
4) To study the cut- sectional models of Reciprocating and Rotary Refrigerant compressor.
5) To study the various controls used in Refrigerating & Air Conditioning systems.
6) To study the Ice- plant, its working cycle and determine its C.O.P and capacity.
7) To study the humidification, heating, cooling and dehumidification processes and plot them on Psychrometric charts.
8) To determine the By-pass factor of Heating & Cooling coils and plot them on Psychrometric charts on different inlet conditions.
9) To determine sensible heat factor of Air on re-circulated air-conditioning set up.
10) To study the chilling plant and its working cycle.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the vapour compression refrigeration system and vapour absorption system.

CO 2- Application of different compressors used in refrigeration system.

CO 3- Understand functioning of various control devices

CO 4- Evaluate the COP of various refrigeration system such as vapour compression refrigeration system and vapour absorption system.

CO 5- Knowledge of how the loading condition changes the COP of the system.

Note :

1) At least six experiments are to be performed in the semester.
2) At least seven experiments should be performed form the above list. Remaining two experiments may either be performed from the above list or as designed & set by the concerned institute as per the scope of the syllabus.

Course code	**PCC- ME-405G**				
Category	Professional Core Courses				
Course title	**SEMINAR**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	0	0	2	1	
Objectives:	To teach the student how to face interview and presentation given and remove their hesitation and improve their communications skills and overall personal developments.				
Internal Class Marks	25 Marks				
External Class Marks	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Selecting of Seminar Topics by Teacher or concerned to teacher by students. A seminar topic given by students in semester.

<table>
<tr><td>Course code</td><td colspan="5">PROJ-ME-407G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">PROJECT-I</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VII</td></tr>
<tr><td>0</td><td>0</td><td>9</td><td>4.5</td></tr>
<tr><td>Objectives:</td><td colspan="5">This course is aimed to provide more weightage for project work. The project work could be done in the form of a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.</td></tr>
<tr><td>Internal Project Marks</td><td colspan="5">25</td></tr>
<tr><td>External Project Marks</td><td colspan="5">25</td></tr>
<tr><td>Total</td><td colspan="5">50</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

The students expected to take up a project under the guidance of teacher from the college. The project must be based on mechanical engineering problems, which can be extended up to the full semester. The students may be asked to work individually or in a group normally not more than four –six students in a group(If any large/big projects occurs then strength of students increases ap per guide supervision). Viva- voce must be based on the preliminary report submitted by students related to the project.

Course code	PT-ME-409G				
Category	Engineering Science Courses				
Course title	PRACTICAL TRAINING-II				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	0	0	2	0	
Objectives:	• Achieving the objectives of the University and its colleges and departments in practical training. • Providing students with practical skills, which match the requirements of the job market and allow them to directly enter the work community in a serious and constructive manner. • Providing students with experience to help them take decisions pertaining to their future career objectives. • Providing college students the full opportunity to apply theoretical knowledge (gained during their studies) in a real work environment at a later stage of their studies. • Developing the student's understanding of the needs of the job market and reaching this understanding successfully				
Internal Practical Training Marks	25 Marks				
External Practical Training Marks	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

PRACTICAL TRAINING VIVA-VOCE:

1) Assessment of Practical Training-II, undergone at the end of VI semester, will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the industry/ Professional organization/ Research Laboratory with the prior approval of the Director-Principal/ Mechanical Software /Automobile Workshop. **According to performance letter grades A, B, C, F are to be awarded: Excellent : A ; Good : B ; Satisfactory : C ; Not satisfactory : F.** A student who has been awarded 'F' grade will be required to repeat the practical training.

2) **Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the VII semester.**

Course code	**MC-317G**				
Category	Mandatory Course				
Course title	**Constitution of India**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	2	0	0	0	

MC-317G is mandatory non-credit course in which the students will be awarded grades.

Note: 2 The students will be awarded grades A, B, C & F in Evaluation of Constitution of India. A student who is awarded 'F' grade is required to repeat .

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Course Objectives: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

UNIT-II

Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT-III

Organs of Governance: President – Qualification and Powers of the President, GovernorQualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

UNIT-IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

Course Outcomes: Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

4. Discuss the passage of the Hindu Code Bill of 1956. The examination of the regular students will be conducted by the concerned college/Institute internally.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.

2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition

3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition

4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

Course code	**PCC-ME-402G**				
Category	Professional Core Courses				
Course title	INDUSTRIAL **AUTOMATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	It has been at the forefront of creating new platforms that impact the nation's competitiveness in manufacturing and infrastructure. Automation Industry has been propelling economies internationally by enabling manufacturing and infrastructure to meet the growing needs across the globe. This cross disciplinary segment is the key to enhanced productivity, reliability and quality in multiple domains.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, introduction to automation productivity.

Material handling systems: Overview of Material Handling Systems-Rotary feeders, oscillating force feeder, Vibratory feeder, elevator type and Centrifugal type feeders, Principles and Design Consideration, Material Transport Systems, Storage Systems.

UNIT-II

Automated Manufacturing Systems: Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation, Flow lines & Transfer Mechanisms, Fundamentals and Analysis of Transfer Lines, product design for automatic assembly.

Control Technologies in Automation: Industrial Control Systems ,Process Industries Verses Discrete-Manufacturing Industries, Continuous Verses Discrete Control, Computer Process and its Forms. Sensors, Actuators and other Control System Components.

UNIT-III

Evaluation of automatic production: product manufacturabiiity, orientation devices-active and passive devices, parts orientation and escapement.

Pneumatic and hydraulic components and circuits: Boolean algebra, pneumatic sensors and amplifiers, jet destruction devices, logic devices, schimit triggering devices, developing pneumatic circuits for automatic die casting machine.

UNIT-IV

Modeling and Simulation for manufacturing Plant Automation: Introduction/need for system Modeling, Building Mathematical Model of a manufacturing Plant, Modern Tools Artificial neural networks in manufacturing automation, A Iin manufacturing, Fuzzy decision and control, robots and application of robots for automation.

Course Outcomes (COs): At the end of the course, the student shall be able to get practical exposure of Automation Industry has been propelling economies internationally by enabling manufacturing and infrastructure to meet the growing needs across the globe. This cross disciplinary segment is the key to enhanced productivity, reliability and quality in multiple domains.

Reference Books:

1) Hand book of design, manufacturing and Automation: R.C. Dorf, John Wiley and Sons.
2) Automation, Production Systems and Computer Integrated Manufacturing, M. P. Groover, Pearson Education.
3) Industrial Automation: W.P. David, John Wiley and Sons.
4) Computer Based Industrial Control, Krishna Kant, EEE-PHI
5) An Introduction to Automated Process Planning Systems, Tiess Chiu Chang & Richard A.Wysk
6) ManufacturingassemblyHandbook:-Bruno Lotter
7) Anatomy of Automation ,Amber G.H&P.S. Amber, Prentice Hall.
8) PerformanceModelingofAutomatedManufacturingSystems,Viswanandham,PHI.
9) Automatic process control system and Hardware-R.P. Hunter, Prentice Hall.

Course code	PEC-ME-402G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-IV)				
Course title	**TOOL DESIGN**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The main objective of tool design is to increase production while maintaining quality and lowering costs.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Tool design Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non ferrous Tooling Materials- Carbides, Ceramics and Diamond -Non metallic tool materials Designing with relation to heat treatment .

Design of cutting Tools Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle - Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters .

UNIT-II

Design of Jigs and Fixtures Introduction – Fixed Gages – Gage Tolerances –selection of material for Gages – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General considerations in the design of drill jigs – Drill bushings – Methods of construction –Thrust and Turning Moments in drilling - Drill jigs and modern manufacturing- Types of Fixtures – Vise Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Modular Fixtures – Cutting Force Calculations.

UNIT-III

Design of Forming Tools Types of Sheet Metal Dies –Method of Die operation–Clearance and cutting force calculations- Blanking and Piercing die design – Pilots – Strippers and pressure pads Presswork materials – Strip

layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing dies-Design and drafting. Design of Bulk forming dies and moulds for metals and plastics.

UNIT-IV

Tool Design for CNC machine tools Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools- Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine .

Course Outcomes (CO'S): At the end of the course, the student shall be able to: understand tool design concept and how to increase production while maintaining quality and lowering costs.

Books:

1) Cyrll Donaldson, George H.LeCain, V.C. Goold, "Tool Design", Tata McGraw Hill Publishing Company Ltd., 2000.
2) E.G.Hoffman," Jig and Fixture Design", Thomson Asia Pvt Ltd, Singapore, 2004
3) Venkataraman K., "Design of Jigs, Fixtures and Presstools", TMH, 2005
4) Haslehurst M., "Manufacturing Technology", The ELBS, 1978.

Course code	PEC-ME-404G				
Category	Professional Elective Courses(PEC) (Semester-VIII) (List-IV)				
Course title	**PLANT MAINTENANCE ENGG**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	• To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities. • To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements. • To illustrate some of the simple instruments used for condition monitoring in industry.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Principles and Practices of Maintenance:-Awareness on maintenance and plant engineering maintenance, objectives o maintenance and plant engineering, state of plant, functions and responsibilities; Installation, commissioning, spare part management function, utility and service function, maintenance planning function, physical assets management, Basic Principles of maintenance planning – Planning function in maintenance, maintenance organization, systems of plant engineering and management, decentralization in plant engineering, advantages and drawbacks of decentralization, staffing in plant engineering, Directing, plant engineering and management as integrating function.

UNIT-II

Maintenance Strategies: Introduction, failure based maintenance, contractual maintenance, reliability centered maintenance, Time based maintenance, Condition based maintenance, maintenance strategy, hurdles in formulating maintenance strategy. Maintenance procedure and their selection, characteristics of maintenance strategy.

UNIT-III

Facility Planning and Plant Layout: Introduction, objectives of good facility planning, principles o facility layout, facility location study, facilities governing selection of location, steps in facility location study, plant layout, flow patterns to facilities assembly lines

UNIT-IV

Spare Parts Management: Introduction, features/characteristics of spare parts, functions of spare parts management, classification of spare parts- ABC analysis, SDE Analysis, VED Analysis, CIN Analysis, HML analysis, XYZ analysis, maintenance system optimization, codification, standardization, levels of standards, advantages of standardization, barriers to standardization

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

1) To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2) To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
3) To illustrate some of the simple instruments used for condition monitoring in industry.

Text Books:

1) Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 1981
2) Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995

References Books:

1. White E.N., "Maintenance Planning", I Documentation, Gower Press, 1979.
2. Garg M.R., "Industrial Maintenance", S. Chand & Co., 1986.
3. Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill, 5th Edition, 1988.
4. Armstrong, "Condition Monitoring", BSIRSA, 1988.
5. Davies, "Handbook of Condition Monitoring", Chapman &Hall, 1996.
6. "Advances in Plant Engineering and Management", Seminar Proceedings - IIPE, 1996.

Course code	PEC-ME-406G				
Category	Professional Elective Courses(PEC) (Semester-VIII) (List-IV)				
Course title	**Design And Optimization Of Thermal Energy Systems**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To learn basic principles underlying piping, pumping, heat exchangers; modeling and optimization in design of thermal systems. To develop representational modes of real processes and systems. To optimization concerning design of thermal systems.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

DESIGN CONCEPTS:-Design Principles, Workable Systems, Optimal Systems, Matching of System Components, Economic Analysis, Depreciation, Gradient Present Worth factor, modelling overview – levels and steps in model development - Examples of models – curve fitting and regression analysis .

UNIT-II

MODELLING AND SYSTEMS SIMULATION :-Modelling of thermal energy systems – heat exchanger - solar collectors – distillation - rectification turbo machinery components - refrigeration systems - information flow diagram - solution of set of nonlinear lgebraic equations - successive substitution - Newton Raphson method- examples of thermal systems simulation

UNIT-III

OPTIMIZATION :-constraints, problem formulation - unconstrained problems - necessary and sufficiency conditions. Constrained optimization - Lagrange multipliers, constrained variations, Linear Programming - Simplex tableau, pivoting, sensitivity analysis - New generation optimization techniques – examples

UNIT-IV

DYNAMIC BEHAVIOUR :- Steady state Simulation, Laplace Transformation, Feedback Control Loops, Stability Analysis, Non-Linearities

APPLICATIONS AND CASE STUDIES :- Case studies of optimization in thermal systems problems- Dealing with uncertainty- probabilistic techniques – Trade-offs between capital and energy using Pinch analysis

Course Outcomes (CO'S): At the end of the course, the student shall be able to: understand modeling and optimization of Thermal systems.

REFERENCES Books:-

1. B.K.Hodge, Analysis and Design of Thermal Systems, Prentice Hall Inc., 1990.
2. Bejan A., George Tsatsaronis , Michael J. Moran , Thermal Design and Optimization, Wiley , 1996.
3. D.J. Wide, Globally Optimal Design, Wiley- Interscience, 1978.
4. Kapur J. N., Mathematical Modelling , Wiley Eastern Ltd , New York , 1989.
5. Rao S. S., Engineering Optimization Theory and Practice, New Age Publishers, 2000.
6. Stoecker W. F., Design of Thermal Systems, McGraw Hill Edition, 1989.
7. YogeshJaluria , Design and Optimization of Thermal Systems , CRC Press , 2007.

Course code	PEC-ME-408G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-IV)				
Course title	**GAS DYNAMICS AND JET PROPULSION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	1. To understand the features of compressible isentropic flows and irreversibilities like shocks. 2. To provide a basic knowledge of jet and rocket propulsion technologies.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Compressible flow, definition, Mach waves and Mach cone, stagnation states, Mass, momentum and energy equations of one-dimensional flow, Isentropic flow through variable area ducts, nozzle s and diffusers, subsonic and supersonic flow I variable area ducts, choked flow, Area-Mach number relations for isentropic flow .

UNIT-II

Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables.

UNIT-III

Theory of jet propulsion, thrust equation, thrust power and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines.

UNIT-IV

Types of rocket engines, propellants & feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights

Course Outcomes: Upon completion of this course, the students will be able to apply gas dynamics principles to jet and space propulsion systems

Text Books:

1. Ahmed F. El-Sayed, Aircraft Prpoulsion and Gas Turbine Engines, CRC Press, 2008.

2. H.S. Mukunda, “Understanding Aerospace Chemical Propulsion”, Interline Publishing, 2004.

3. Hill P. and Peterson C., Mechanics & Thermodynamics of Propulsion, Addison Wesley, 1992.

4. Zucrow N. J., Aircraft and Missile Propulsion, Vol.I& II, John Wiley, 1975.

5. Sutton G.P., Rocket Propulsion Elements, John Wiley, New York, 1986.

Course code	PEC-ME-412G				
Category	Professional Elective Courses(PEC) (Semester-VIII) (List-V)				
Course title	**POWER PLANT ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To provide an overview of power plants and the associated energy conversion issues.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

UNIT-II

Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.

Combined Cycles: Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal, using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles. Problems.

UNIT-III

Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.

Power Plant Economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-output curves, efficiency, heat rate, economic load sharing, Problems.

UNIT-IV

Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors, low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Understand the principles of steam power plants and gas power plants.

CO2 - Utility and applications of nuclear power plant.

CO3 - Installation and commissioning of hydro-electric power plants.

CO4 - Understand various factors affecting non-conventional power plant.

CO5 - understand the principles of operation for different power plants and their economics.

Text Books :

1. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata Mc Graw Hill Publishing Campany Ltd., New Delhi
2. Power Plant Engineering : P.K. Nag Tata McGraw Hill second Edition 2001.

Reference Books :

1. Power Plant Engg. : M.M. El-Wakil McGraw Hill 1985.

Course code	PEC-ME-414G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-V)				
Course title	**PRODUCT DESIGN AND DEVELOPMENT**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The objective of product development is to cultivate, maintain and increase a company's market share by satisfying a consumer demand. Not every product will appeal to every customer or client base, so defining the target market for a product is a critical component that must take place early in the product development process. Quantitative market research should be conducted at all phases of the design process, including before the product or service is conceived, while the product is being designed and after the product has been launched.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

DESIGN PROCESS – The design process - Morphology of Design - Design drawings - Computer Aided Engineering - Designing of standards - Concurrent Engineering - Product life cycle - Technological Forecasting - Market Identification - Competition Bench marking - Systems Engineering - Life Cycle Engineering - Human Factors in Design - Industrial Design.

UNIT-II

DESIGN METHODS – Creativity and Problem Solving - Product Design Specifications - Conceptual design - Decision theory - Embodiment Design - Detail Design - Mathematical Modeling - Simulation - Geometric Modeling - Finite Element Modeling - Optimization - Search Methods - Geometric Programming - Structural and Shape Optimization.

UNIT-III

INTRODUCTION TO SOLID MECHANICS: Stress, Strain in 2-d and 3-d, relation between stress and strain, theories of failure.

MATERIAL SELECTION PROCESSING AND DESIGN – Material selection Process - Economics - Cost Vs Performance - Weighted property Index - Value Analysis - Role of Processing and Design - Classification of Manufacturing Process - Design for Manufacture - Design for Assembly - Design for castings, Forging, Metal Forming, Machining and Welding - Residual stresses - Fatigue, Fracture and Failure.

UNIT-IV

ENGINEERING STATISTICS AND RELIABILITY – Probability - Distributions - Test of Hypothesis - Design of Experiments - Reliability Theory - Design of Reliability - Reliability centered Maintenance.

QUALITY ENGINEERING – Total Quality Concept - Quality Assurance - Statistics Process Control - Taguchi Methods - Robust Design - Failure Model Effect Analysis.

Course Outcomes (CO'S): At the end of the course, the student shall be able to: to understand how product development is to cultivate, maintain and increase a company's market share by satisfying a consumer demand. They know, how quantitative market research should be conducted at all phases of the design process, including before the product or service is conceived, while the product is being designed and after the product has been launched.

Text Books:

1. Dieter George E., "Engineering Design – A Materials and Processing Approach", McGraw Hill, International Edition Mechanical Engg ., Series ,1991.

2. Karl t. Ulrich and Steven d Eppinger "Product Design and Developement " ,McGraw Hill,Edition 2000.

3. Palh .G. and Beitz .W., " Engineering Design ", Springer - Verlag , NY. 1985. 4. Ray .M.S., " Elements of Engg. Design ", Prentice Hall Inc . 1985.

5. Suh .N.P. , " The Principle of Design ", Oxford University Press , NY. 1990.

Course code	**PEC-ME-416G**				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-V)				
Course title	**NON CONVENTIONAL ENERGY RESOURCES UTILIZATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The main purpose of fuel is to store energy, which should be in a stable form and can be easily transported to the place of use. The user employs this fuel to generate heat or perform mechanical work, such as powering an engine. It may also be used to generate electricity, which is then used for heating, lighting, or other purposes.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Principles Of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

Solar Energy Collection:Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

UNIT-III

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermoelectric generators, seebeck, peltier and joul Thomson effects, Figure of merit, materials, applications, MHD generators, principles,

dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faradays laws, thermodynamic aspects, selection of fuels and operating conditions.

UNIT-IV

Bio-Mass:Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects..

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Course Outcomes (COs): At the end of the course, the student shall be able to: understanding of fuel is to store energy, which should be in a stable form and can be easily transported to the place of use. The user employs this fuel to generate heat or perform mechanical work, such as powering an engine. It may also be used to generate electricity, which is then used for heating, lighting, or other purposes.

Reference Book:

1) Renewable energy resources/ Tiwari and Ghosal/Narosa.
2) Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3) Non-Conventional Energy Systems / K Mittal/Wheeler

Text books:

1) Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.
2) John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3) M.V.R. Koteswara Rao, “Energy Resources: Conventional & Non-Conventional” BSP Publications,2006.
4) D.S. Chauhan,”Non-conventional Energy Resources” New Age International.
5) C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.
6) Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
7) Godfrey Boyle,“ Renewable Energy Power For A Sustainable Future”, Oxford University Press.

Course code	PEC-ME-418G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-V)				
Course title	**INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To introduce nanotechnology and nanostructures . To introduce fabrication and characterization techniques used in nanotechnology.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Background to Nanoscience: Defination of Nano, Scientific revolution-Atomic Structure and atomic size, emergence and challengs of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties.

UNIT-II

Types of nanostructure and properties of nanomaterials: One dimensional, Two dimensional and Three dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.

UNIT-III

Application of Nanomaterial: Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application.

UNIT-IV

Nanomachines: covalent and non covalent approaches, Molecular motors and machines, molecular devices, single molecular devices, practical problems with molecular deviceNanofluids: nanoparticles, preparation of nanofluids, thermophysical properties of nanofluids in comparison with base fluid. Nanoswitches - nano computers- nanofilters

Course Outcomes : At the end of the course, the student shall be able to:

- ❖ Understand properties of materials at nanoscale
- ❖ Know the fabrication and characterization methods used in nanotechnology
- ❖ Acquaint with the various applications of nanotechnology.

Text books:

1. A.K. Bandyopdhyay, Nanomaterials, , New age international publishers,2008
2. Bharat Bhushan, Springer Handbook of Nanotechnology, 2010 Charles P Poole, Frank J Owens, Introduction to Nanotechnology, John Wiley and Sons, 2003
3. Jeremy Ramsden,Nanotechnology, William Andrew, Elsevier, 2011
4. T Pradeep, Nano: The essentials, McGraw – Hill education,2 007
5. V.S.Muralidharan, A Subramnya,Nano science and Technology, Ane books Pvt Ltd

Reference books:

1. Gregory Timp, Nanotechnology, Springer-Verlag, 2009
2. John Mongillo, Nano Technology, Greenwood Press, 2007
3. Kelsall Robert. W, Ian Hamley, MarkGeoghegan, Nanoscale Science and Technology, Wiley Eastern,2005
4. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al.
5. Nanoparticles: From theory to applications – G. Schmidt, Wiley Weinheim 2004.
6. Instrument E L Principe, P Gnauck and P Hoffrogge, Microscopy and Microanalysis (2005), 11: 830-831, Cambridge University Press.
7. Processing & properties of structural naonmaterials - Leon L. Shaw, Nanochemistry: A Chemical Approach to Nanomaterials, Royal Society of Chemistry, Cambridge UK 2005.

Course code	PEC-ME-420G				
Category	Professional Elective Courses(PEC) (Semester-VIII) (List-VI)				
Course title	**AUTOMOBILE ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To understand the construction and working principle of various parts of an automobile.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Automobiles : Classification, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles.

Clutches : Requirement of Clutches – Principle of Friction Clutch – Wet Type & Dry Types; Cone Clutch, Single Plate Clutch, Diaphragm Spring Clutch, Multi plate Clutch, Centrifugal Clutches, Electromagnetic Clutch, Over Running Clutch; Clutch Linkages.

UNIT-II

Power Transmission: Requirements of transmission system; General Arrangement of Power Transmission system; Object of the Gear Box; Different types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes; Epi-cyclic Gear Box, Freewheel Unit. Overdrive unit-Principle of Overdrive, Advantage of Overdrive, Transaxle, Transfer cases.

Drive Lines, Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles, Types of load coming on Rear Axles, Full Floating, Three quarter Floating and Semi Floating Rear Axles.

UNIT-III

Suspension Systems : Need of Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs.

Steering System : Front Wheel geometry & Wheel alignment viz. Caster, Camber, King pin Inclination, Toein/Toe-out; Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes; Steering linkages and layout; Power steering – Rack & Pinion Power Steering Gear, Electronics steering.

UNIT-IV

Automotive Brakes, Tyres & Wheels : Classification of Brakes; Principle and constructional details of Drum Brakes, Disc Brakes; Brake actuating systems; Mechanical, Hydraulic, Pneumatic Brakes; Factors affecting Brake performance, Power & Power Assisted Brakes; Tyres of Wheels; Types of Tyre & their constructional details, Wheel Balancing, Tyre Rotation; Types of Tyre wear & their causes.

Emission Control System & Automotive Electrical : Sources of Atmospheric Pollution from the automobile, Emission Control Systems – Construction and Operation of Positive Crank Case Ventilation (PVC) Systems, Evaporative Emission Control, Heated Air Intake System, Exhaust Gas Recirculation (ECR) Systems, Air Injection System and Catalytic Converters; Purpose construction & operation of lead acid Battery, Capacity Rating & Maintenance of Batteries; Purpose and Operation of Charging Systems, Purpose and Operations of the Starting System; Vehicle Lighting System.

Course Outcomes : At the end of the course, the student shall be able to:

CO1 - Identify the different parts of the automobile

CO2 - Explain the working of various parts like engine, transmission, clutch, brakes.

CO3 - Describe how the steering and the suspension systems operate.

CO4 - Understand the environmental implications of automobile emissions.

CO5 - Understand the function of each automobile component and also have a clear idea about the overall vehicle performance.

CO6 - Develop a strong base for understanding future developments in the

Text Books:

1) Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
2) Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.

Reference Books:

1) Automotive Mechanics – Crouse / Anglin, TMH.
2) Automotive Technology – H.M. Sethi, TMH, New Delhi.
3) Automotive Mechanics – S.Srinivasan, TMH, New Delhi.
4) Automotive Mechanics – Joseph Heitner, EWP.
5) Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers, Inc.
6) The Motor Vehicle – Newton steeds Garrett, Butter Worths.

Course code	PEC-ME-422G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-VI)				
Course title	**DESIGN OF TRANSMISSION SYSTEMS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To learn about the design procedures for mechanical power transmission components Contents: Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Gear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, factor safety, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.

UNIT-II

Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.

UNIT-III

Gear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of sliding mesh gear box- Design of multi-seed gear box for machine tool applications; constant mesh gear box, speed reducer unit; Variable speed gear box; Fluid couplings, Torque converters for automotive applications.

UNIT-IV

Cam design, types: pressure angle and undercutting base circle determination, forces and surface stresses; Design of plate clutches, axial clutches, cone clutches, internal expanding rim clutches; Electromagnetic clutches; Band and Block brakes, external shoe brakes, internal expanding shoe brake.

Course Outcomes: Upon completing this course the students will be able to design transmission systems for engines and machines.

Text Books:

1. Shigley J., Mischke C., Budynas R. and Nisbett K., Mechanical Engineering Design, 8th ed., Tata McGraw Hill, 2010.

2. Jindal U.C., Machine Design: Design of Transmission System, Dorling Kindersley, 2010.

3. Maitra G. and Prasad L., Handbook of Mechanical Design, 2nd ed., Tata McGraw Hill, 2001

Course code	PEC-ME-424G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-VI)				
Course title	**ALTERNATE FUELS AND ENERGY SYSTEMS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The main purpose of fuel is to store energy, which should be in a stable form and can be easily transported to the place of use. Almost all fuels are chemical fuels. The user employs this fuel to generate heat or perform mechanical work, such as powering an engine. It may also be used to generate electricity, which is then used for heating, lighting, or other purposes.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Estimation of petroleum reserve-Need for alternate fuel-Availability and properties of alternate fuels-general use of alcohols- LPG-Hydrogen-Ammonia, CNG, and LNG-Vegetable oils and Biogas-Merits and demerits of various alternate fuels.

UNIT-II

Alcohols: Properties as engine fuels, alchohols and gasoline blends-Combustion characteristics in engines-emission characteristics. Vegetable Oils: Various vegetable oils for engines Esterification-Performance in engines-Performance and emission characteristics

UNIT-III

Natural Gas, LPG, Hydrogen and Biogas: Availability of CNG, properties modification required to use in engines-performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG-Hydrogen-Storage and handling, performance and safety aspects.

UNIT-IV

Electrical and Solar Powered Vehicles: Layout of an electric vehicle-Advantage and limitationsSpecifications-System component, Electronic control system-High energy and power density batteries-Hybrid vehicle-Solar powered vehicles.

Course Outcomes (COs): At the end of the course, the student shall be able to: understand how the fuel is to store energy, which should be in a stable form and can be easily transported to the place of use. Almost all fuels are chemical fuels. The user employs this fuel to generate heat or perform mechanical work, such as powering an engine. It may also be used to generate electricity, which is then used for heating, lighting, or other purposes.

Reference Books :

1) Maheswar Dayal, Energy today & tomorrow, I & B Horishr India,1982
2) Nagpal, Power Plant Engineering, Khanna Publishers,1991.
3) Alchohols and Motor fuels progress in technology, Series No.19,SAEPublicartion USA 1980.
4) SAE paper Nos.840367, 841156,841333,841334.
5) The properties and performance of modern alternate fuels SAE paper No 841210.
6) Bechtold.R.L. Alternative Fuels Guide Book, SAE, 1997.

Course code	PEC-ME-426G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-VI)				
Course title	**OPTIMISATION FOR ENGINEERING DESIGN**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The main aim of to understanding while engineering design problems can often be conveniently formulated as multiobjective optimization problems, these often comprise a relatively large number of objectives. Such problems pose new challenges for algorithm design, visualisation and implementation.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Single Variable Optimization for engineering design: Introduction-Engineering optimization problems-Optimality criteria-Bracketing methods-Region elimination methods-Point estimation methods-Gradient based methods-Root finding using optimization techniques- Computer programmes.

UNIT-II

Multi Variable Optimization Algorithm: Optimality criteria-Unidirectional search-Direct search methods-gradient based methods- Computer programmes.

Constrained Optimization Algorithms: Kuhn – Tucker conditions –Transformation methods – sensitivity analysis.

UNIT-III

Direct search for constrained minimization-Unearized search techniques – feasible direct method-generalised reduction gradient method-Gradient projection method- Computer programmes.

Specialized Algorithms : Integer programming – Geometric programming.

UNIT-IV

Non-Traditional Optimization Algorithms: Genetic algorithms – Simulated annealing – Global optimization – Computer programmes.

Course Outcomes (COs): At the end of the course, the student shall be able to: understanding while engineering design problems can often be conveniently formulated as multiobjective optimization problems, these often comprise a relatively large number of objectives. Such problems pose new challenges for algorithm design, visualisation and implementation..

Reference Books :

1. Kalyanmay Deb, Optimization for Engineering Design, Prentice Hall of India, New Delhi.
2. Taha. M.A., Operations Research, Macmillan, New York, 1989
3. Rao.S.S., Optimisation Theory and Application, Wiley Eastern, New Delhi, 1990
4. Muirthy, Linear Programming, Wiley, New York, 1987.
5. Rekiaaitis. G.V. Ravindran.A. And Regedell K.M., Engineering optimization methods and applications, Wiley, New York, 1986.
6. Conley. W., Computer Optimization Techniques, Pntrecelli Book, 1980.

Course code	OEC –ME-402G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**OPERATIONS RESEARCH**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The aims of operation research include: solving operational questions, solving questions related to resources' operations, and solving decision-making questions. Operational research has a relation with different areas of study and it has several applications. Operation research is considered as a tool of productivity. In comparison to traditional approaches, operation research provides more extensive, quantitative, and detailed information about different issues and managers can implement their decisions based on quantitative analyses. Operation research will be a good assistance for managers in different areas.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods.

Linear Programming (LP): Programming definition, formulation, solution- graphical, simplex GaussJordan reduction process in simplex methods, BIG-M methods computational, problems.

UNIT-II

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepperg stone method, MODI methods, degeneracy, assignment, traveling salesman, problems.

Advanced Topic Of LP: Duality, PRIMAL-DUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

UNIT-III

Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.

Project Line Models: Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, optimal project cost by crashing of network, resources leveling in project, problems.

UNIT-IV

Simulation: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems.

Decision Theory: Decision process, SIMON model types of decision making environment- certainty, risk, uncertainty, decision making with utilities, problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Discuss the role of operations research in decision-making, and its applications in industry and should be able to formulate and design real-world problems through models & experiments.

CO 2- Knowledge of various types of deterministic models like linear programming, transportation model etc.

CO 3- Explore various types of stochastic models like waiting line model, project line model, simulation etc.

CO 4- Deduce the relationship between a linear program and its dual and perform sensitivity analysis.

CO 5- Describe different decision making environments and apply decision making process in the real world situations

Text Books:

1) Operation Research – TAHA, PHI, New Delhi.
2) Principle of Operations Research – Ackoff, Churchaman, arnoff, Oxford IBH, Delhi.

Reference Books :

1) Operation Research- Gupta & Sharma, National Publishers, New Delhi.
2) Quantitative Techniques- Vohra, TMH, New Delhi 8. Principles of operation Research (with Applications to Managerial Decisions) by H.M.Wagher, Prentice Hall of India, New Delhi.
3) Operation Research – Sharma, Gupta, Wiley Eastern, New Delhi.
4) Operation Research – Philips, Revindran, Solgeberg, Wiley ISE.

Course code	OEC-ME-410G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**QUALITY ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To understand the concept of Quality Engineering which emphasizes growth, creativity, and analytical thinking.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Section A

Basic Concepts of Quality: Definitions of Quality and its importance in industry, Quality function, Quality Characteristics, Quality process, Quality Traits, Applications of Quality Concept, Introduction to quality control, Computer aided quality control, Total quality control(TQC) and its implementation, Elements of TQC, Quality Circle, Objectives of quality circle, Role of management in quality circle, Quality in service organizations, characteristics of a service organization, Important service dimensions, Design of service quality.

Section B

Basic Statistical Concepts: The Concept of variation, Distinction between variables and attributes data, The frequency distribution, graphical representation of frequency distribution, Quantitative description of distribution, the normal curve, concept of probability, laws of probability, probability distributions, hyper geometric distribution, binomial distribution, The Poisson distribution.

Section C

Quality systems: Quality systems, Need for quality System, Need for standardization, History of ISO:9000 series standards and its features, steps to registration, India and ISO:9000, Automated inspection systems technologies, Different forms of Inspection, Industrial inspection,

Section D

Total Quality Management: Introduction o TQM, Concepts, Characteristics of TQM, Relevance of TQM, Approaches to TQM Implementation, TQM philosophies, Taguchi Philosphy, JIT, Kaizen, Six Sigma approach, 5-S approach

Course Outcomes: Upon completion of this course the student will be able to:

CO1 - Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability

CO2 - Use control charts to analyze for improving the process quality.

CO3 - Describe different sampling plans

CO4 - Acquire basic knowledge of total quality management

CO5 - Understand the modern quality management techniques

Text Books:

1. Quality planning and Analysis, Juran and Gryna, TMH, New Delhi
2. Quality Management, Kanishka Bed, Oxford University Press, New Delhi
3. Introduction to SQC, Montgomery DC, 3e, Wiley, New Delhi
4. Fundamentals of quality control and improvement, A Mitra, Mcmillan pub. Company, NY

Reference Books:

1. Fundamentals of Applied Statistics, Gupta and Kapoor, Sultan Chand and Sons, New Delhi.

Course code	OEC –EE-412G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**ELECTRICAL POWER GENERATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The aims of Electrical power generation include: The aim of subject is to get knowledge about power generation and its related issues.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

INTRODUCTION: Energy sources, their availability, recent trends in Power Generation, Interconnected Generation of Power Plants.

Section-B

POWER GENERATION PLANNING: Load forecasting, load curves, load duration curve, Base load and Peak load Power Plants, connected Load, maximum demand, demand factor, Group diversity factor, load factor, significance of load factor, plant factor, capacity factor, selection of unit size, No. of Units, reserves, cost of power generation, Depreciation, tariff.

Section-C

CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, classification, Schematic diagram and working of Thermal Power Stations, Hydro Electric Plant, Nuclear Power Plant and Diesel Power Stations.

Section-D

ELECTRIC ENERGY CONSERVATION & MANAGEMENT: Energy management, Energy Audit, Energy Efficient Motors, Co-generation.

Course Outcomes: Upon completion of this course the student will be able to:

The knowledge about power generation and its related issues.

TEXT BOOKS:

1. Electric Power Generation, B.R.Gupta
2. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley & Sons,1984.

REF. BOOKS:

1. A Course in Electric Power System, Soni, Gupta, Bhatnagar, Dhanpat Rai & Sons
2. Power System Engineering, Nagrath & Kothari, Tata Mc-Graw Hill, New Delhi
3. Power Plant Engg: G.D. Rai
4. Electric Power: S.L. Uppal (Khanna Publishing)

Course code	OEC-CSE-430G				
Category	Open Elective Courses(OEC) (Semester VIII) List-III				
Course title	**COMPUTER COMMUNICATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	1. To Build an understanding of the fundamental concepts of computer networking and familiarizing the student with the basic taxonomy and terminology of the computer networking and data communication. 2. To outline various models, topologies and devices of Computer Networks. 3. To explain the functions of various layers in Network Reference Model. 4. To apply different network concepts in various network communication protocols.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Data Communication: Need, components, Data representations communication model, Characteristics of an effective Communication system, Transmission modes: Simplex, Half Duplex and Full Duplex. Serial and parallel transmission. Unicasting, Multicasting, Broadcasting, Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM), Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying,

MULTIPLEXING: FDM, WDM, TDM, packet switching and circuit switching.**Transmission Media**: Copper cable, Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable. Introduction to Computer Network: applications, benefits and problems, Types of Networks: PAN, LAN, MAN and WAN.

UNIT-II

Network Topologies: Introduction to Computer Network Topologies: Mesh Topology, Bus Topology, Star Topology, Ring Topology, Tree Topology, Hybrid Topology, Irregular – Topology.

OSI and TCP/IP Model: Layering architecture of networks, OSI model, Functions of each layer, Services and Protocols of each layer.

UNIT-III

Media Access Control, Random Access: ALOHA, CSMA and CSMA/CD. Controlled Access: Reservation, Polling and Token Passing. Channelization: FDMA, TDMA and CDMA

Ethernet: Features and types of LANs, Types of Ethernets- Thicknet, Thinnet, Fast Ethernet and Gigabit and 10G Ethernet etc. Concept of Carrier Sense Multiple Access (CSMA)/CD in Ethernet.

Network addressing: Physical addressing, logical addressing and port addressing, MAC addressing in Ethernet, IP V4 addressing: concept of subnet, network and host address, IP address Classes- A, B, C, D and E classes. Introduction to classless addressing.

UNIT-IV

LAN interconnecting devices: Repeater, Hubs, Switches, Bridges, Routers, Gateways.

Internet and E-mail: Concept of Internet, Advantages of Internet, Security issues in using internet. Application of Internet in various fields: Scientific, Business, Research, Sports, Medicine & Health Care, Engineering, Teaching. HTTP and FTP

Email :concept, Protocols: SMTP, POP, IMAP.

Learning Outcomes: By the end of the course the students will be able to:

1. Independently understand basic computer network technology.

2. Understand and explain Data Communications System and its components.

3. Identify the different types of network topologies and protocols.

4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.

5. Identify the different types of network devices and their functions within a network

Text Book:

1.Andrew S Tanenbaum, Computer Networks, 5th Edition, Pearson publications, 2010.

2. Forouzan, Data Communication and networking ,5th Edition, Tata McGrawHill, 2012.

3. William Stalling, Data & Computer Communication 6th edition, LPE Pearson Education, 2013.

Reference Books:

Data Communications, Computer Networks and Open Systems (4th edition), Halsall Fred, 2000, Addison Wesley, Low Price Edition.

Computer Networks – A System Approach, Larry L. Peterson & Bruce S. Davie, 2 Edition

Computer Networking – ED Tittel , 2002, T.M.H.

Course code	**OEC-CE- 448G**				
Category	Open Elective Courses(OEC) (Semester VIII) List-III				
Course title	**Traffic Engineering and Road Safety**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

COURSE OBJECTIVES:

- Acquaint the students to basic concepts of Traffic and their significance.
- To stimulate the students to think systematically and objectively about various traffic problems

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module-1: Traffic Characteristics: Importance of traffic characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India.

Module-2: Traffic Studies: Traffic volume study, speed study and origin and destination study. Speed and delay study.

Unit-II

Module-3: Traffic Accidents: Accident surveys. Causes of road accidents and preventive measures.Capacity and Level of Service.

Module-4: Relationship between speed, volume and density,PCU, Design service volume, Capacity of non-urban roads. IRC recommendations, Brief review of capacity of urban roads.

Unit-III

Module-5: Traffic Control Devices: Signs, Signals, markings and islands. Types of signs, Types of signals,Design of Signal, Intersections at grade and grade separated intersections. Types of grades separatedintersections, Parking surveys: On street parking, off street parking.

Unit-IV

Module-6 Road safety audit, RSA team, RSA Report, Elements of RSA,Vehicular air pollution and Situation in India, Motor vehicle act, Vehicular emission norms in India and abroad, Alternate fuels, Factors affecting fuel consumption.

COURSE OUTCOMES:

After completing this course, students should be able:

- To realize the significance of traffic engineering in today life.
- To understand the processes involved in traffic studies.
- To appreciate the role of Traffic regulations.

RECOMMENDED BOOKS:

- Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.
- Highway Engg by S.K.Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
- Traffic Engg and Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
- Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N.Delhi.

Course code	**OEC-CE- 450G**				
Category	Open Elective Courses(OEC) (Semester VIII) List-III				
Course title	**Disaster Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

COURSE OBJECTIVES:

- To provide basic conceptual understanding of disasters and its relationships with development.
- Provide an understanding of the social nature of natural hazards and disasters
- Increase awareness of hazards and disasters around the world and the unequal social consequences stemming from disaster events.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Introduction: Terminology,Global and Indian scenario, role of engineer, importance of study in human life, long term effects of disaster. Geological Mass Movement and land disasters, Atmospheric disasters, Disaster Mitigation

Unit-II

Natural Disaster: Nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion

Man-made Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Unit -III

Case Studies: Damage profile analysis- Uttarkashi/Bhuj/Latur earthquakes, Kerala floods, cyclone Fani and Amphan, Bihar floods, Covid 19.

Unit IV

Disaster Management: Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India.Applications of GIS, Remote sensing and GPS in this regard.

COURSE OUTCOMES:

After completing this course, students should be able:

1. To know natural as well as manmade disaster and their extent and possible effects on the economy.
2. To Plan national importance structures based upon the previous history.
3. To acquaint with government policies, acts and various organizational structures associated with an emergency.
4. To know the simple dos and don’ts in such extreme events and act accordingly.

REFERENCE BOOKS:

1. Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423

2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

Course code	**OEC –ECE-453G**				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**MICROPROCESSOR APPLICATION IN AUTOMOBILES SECTOR**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	This course deals with the systematic study of the Architecture and programming issues of 8085-microprocessor family and interfacing with other peripheral ICs and coprocessor. The aim of this course is to give the students basic knowledge of the microprocessors needed to develop the systems using it.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Architecture: General 8 bit microprocessor and its architecture 8085,Z-80 and MC 6800 MPU and its pin functions-Architecture-Functions of different sections.

UNIT-II

Instruction Set: Instruction format-addressing modes-instruction set of 8085 MPU-T-STATE Machine cycle and instruction cycles-Timing diagrams-Different machine cycles-Fetch and execute operations-estimation of execution times.

UNIT-III

Assembly Language Programming: Construct of the language programming-Assembly format of 8085-Assembly Directive-Multiple precision addition and subtraction-BCD to Binary and Binary to BCD Multiplication, Division, Code conversion using look up tables-stack and subroutines. Data Transfer Schemes: Interrupt structure-Programmed I/O, DMA-Serial I/O.

UNIT-IV

Interfacing Devices: Types of interfacing devices-Input/Output ports 8212, 8255,8251,8279. Octal latches and tristate buffers-A/D and D/A converters-Switches, LED’s ROM and RAM interfacing. Applications: Data

acquisitions-Temperature control-Stepper motor control Automotive applications engine control, Suspension system control, Driver information systems, Development of a high speed, high precision learning control system for the engine control.

Course Outcomes (COs): At the end of the course, a student will be able to: Explain the architecture, pin configuration of various microprocessors and Interfacing devices **.**

Reference Books :

1. Ramesh, Goankar.S., Microprocessor Archietecture Programming and Applications, Wiley Eastern Ltd.,New Delhi,1986.

2. Aditya .P. Mathur, Introduction to Microprocessors, III Edition Tata McGraw Hill Publishuing Co Ltd New Delhi,1989.

3. Ahson. S. I., Microprocessors with Applications in Process Control,Tata McGraw Hill New Delhi,1986.

4. SAE Transactions,1986 Sec 3.

5. Jabez Dhinagfar .S., Microprocessor Applications in Automobiles.

6. L. Bianco and A. Labella., Automotive Micro Electronics, Elsevier science Publishers,1986.

Course code	HSMC-10G				
Category	Humanities And Social Sciences Including Management Courses (HSMC)-(Semester-VIII) List-III				
Course title	**MANAGEMENT INFORMATION SYSTEMS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	Its main goals are to help an organization's executives make decisions that improve the organization's agenda and incorporate the company's organizational structure and dynamics to better leverage the organization for a competitive advantage.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

UNIT-I Foundation of Information Systems: Introduction to information system in business, 8 fundamentals of information systems, Solving business problems with information systems, Types of information systems, Effectiveness and efficiency criteria in information system.

UNIT-II

An overview of Management Information Systems: Definition of a management 8 information system, MIS versus Data processing, MIS & Decision Support Systems, MIS & Information Resources Management, End user computing, Concept of an MIS,Structure of a Management information system. **UNIT-III**

Concepts of planning: Concept of organizational planning, The Planning Process, 8 Computational support for planning. Business applications of information technology: Internet & electronic commerce and its applications Enterprise Solutions, Information System for Business Operations(SDLC),Information System for Strategic Advantage, Decision Support Systems and its benefits and characteristics.

UNIT-IV

Managing Information Technology: Enterprise & global management, Security & 8 Ethical challenges, Planning & Implementing changes. Advanced Concepts in Information Systems: Enterprise Resource Planning, Supply Chain Management, Customer Relationship Management, and Procurement Management.

Course Outcomes (COs): Upon successful completion of this course, students will be able to CO1. Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making. CO2. Analyze and synthesize business information and systems to facilitate evaluation of strategic alternatives. CO3. Effectively communicate strategic alternatives to facilitate decision making.

Text Book:

1. O Brian, “Management Information System”, TMH
2. Gordon B. Davis & Margrethe H. Olson, “Management Information System”, TMH
3. Ravi Kalakota, Andrew Winston, “Frontiers of Electronic Commerce”, Addison Wesley.

Refrence Books:-

1. O Brian, “Introduction to Information System”, MCGRAW HILL.
2. Murdick, “Information System for Modern Management”, PHI.
3. Jawadekar, “ Management Information System”, TMH.
4. Jain Sarika, “Information System”, PPM
5. Davis, “Information System”, Palgrave Macmillan

Course code	**LC-ME -402G**				
Category	Professional Core Courses				
Course title	**WORKSHOP LAB-IV**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	0	0	2	1	
Objectives:	To understand the construction and working principle of various parts of an automobile.				
Internal Practical Marks	25 Marks				
External Practical Marks	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments :

1. To study and prepare report on the constructional details, working principles and operation of the following Automotive Engine Systems & Sub Systems.
    (a) Multi-cylinder : Diesel and Petrol Engines.
    (b) Engine cooling & lubricating Systems.
    (c) Engine starting Systems.
    (d) Contact Point & Electronic Ignition Systems.
2. To study and prepare report on the constructional details, working principles and operation of the following Fuels supply systems:
    (a) Carburetors
    (b) Diesel Fuel Injection Systems
    (c) Gasoline Fuel Injection Systems.
3. To study and prepare report on the constructional details, working principles and operation of the following Automotive Clutches.
    (a) Coil-Spring Clutch
    (b) Diaphragm – Spring Clutch.
    (c) Double Disk Clutch.
4. To study and prepare report on the constructional details, working principles and operation of the following Automotive Transmission systems.
    (a) Synchromesh – Four speed Range.
    (b) Transaxle with Dual Speed Range.
    (c) Four Wheel Drive and Transfer Case.
    (d) Steering Column and Floor – Shift levers.

5. To study and prepare report on the constructional details, working principles and operation of the following Automotive Drive Lines & Differentials.
    (a) Rear Wheel Drive Line.
    (b) Front Wheel Drive Line.
    (c) Differentials, Drive Axles and Four Wheel Drive Line.
6. To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.
    (a) Front Suspension System.
    (b) Rear Suspension System.
7. To study and prepare report on the constructional details, working principles and operation of the following Automotive Steering Systems.
    (a) Manual Steering Systems, e.g. Pitman –arm steering, Rack & Pinion steering.
    (b) Power steering Systems, e.g. Rack and Pinion Power Steering System.
    (c) Steering Wheels and Columns e.g. Tilt & Telescopic steering Wheels, Collapsible Steering Columns.
8. To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels.
    (a) Various Types of Bias & Radial Tyres.
    (b) Various Types of wheels.
9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
    (a) Hydraulic & Pneumatic Brake systems.
    (b) Drum Brake System.
    (c) Disk Brake System.
    (d) Antilock Brake System.
    (e) System Packing & Other Brakes.
10. To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.
11. Modeling of any two automotive systems on 3D CAD using educational softwares (eg. 3D modeling package/Pro Engineering/I-Deas/ Solid edge etc.)
12. Crash worthiness of the designed frame using Hypermesh and LS-Dyna solver or other software.

Course Outcomes (COs): At the end of the course, the student shall be able to get practical exposure of:

CO 1- Principle of automobiles drive and advances in automobiles.

CO 2- Various types of clutch.

CO 3- Various types of steering system along with merits and demerits.

CO 4- Various type of hybrid vehicles.

CO 5- Hydrogen based technology for pollution control

Note :

1. At least ten experiments are to be performed in the Semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or as designed & set by the concerned institution as per the scope of the syllabus.

Course code	**PCC- ME-406G**				
Category	Professional Core Courses				
Course title	**SEMINAR**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	0	0	2	1	
Objectives:	To teach the student how to face interview and presentation given and remove their hesitation and improve their communications skills and overall personal developments.				
Internal Practical Marks	25 Marks				
External Practical Marks	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Selecting of Seminar Topics by Teacher or concerned to teacher by students. A seminar topic given by students in semester.

Course code	**PROJ-ME-408G**				
Category	Professional Core Courses				
Course title	**PROJECT-II**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	0	0	10	5	
Objectives:	This course is aimed to provide more weightage for project work. The project work could be done in the form of a major practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.				
Internal Project Marks	75 Marks				
External Project Marks	75 Marks				
Total	150 Marks				
Duration of Exam	03 Hours				

The students expected to take up a project under the guidance of teacher from the college. The project must be based on mechanical engineering problems, which can be extended up to the full semester. The students may be asked to work individually or in a group normally not more than four –six students in a group(If any large/big projects occurs then strength of students increases ap per guide supervision). Viva- voce must be based on the preliminary report submitted by students related to the project.