A N N A M A L A I U N I V E R S I T Y

A N N A M A L A I N A G A R

H A N D B O O K

(Regulations and Syllabi)

Bachelor of Engineering (Mechanical)

Choice Based Credit System (CBCS)

2007 – 2008
2008 – 2009
2009 – 2010
2010 – 2011

FOUR YEAR B.E. DEGREE COURSE

REGULATIONS AND SYLLABI

R1.Condition for Admission:

Candidates for admission to the first year of the four year B.E. Degree Courses shall be required to have passed the final examination of the plus 2 Higher Secondary Course with Mathematics, Physics and chemistry as subjects of study conducted by the board of secondary Education, Tamilnadu Government or an examination of any other authority accepted by the syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the syndicate of the Annamalai University from time to time. Candidates who have passed the Higher Secondary Examination through vocational stream under ENGINEERING AND TECHNOLOGY and candidates who have passed the Diploma Course in Engineering of the State Board of Technical Education and Training, Tamilnadu, will also be eligible for admission to the first year of the four year degree course in B.E. provided they satisfy other conditions.

R2. Eligibility for the degree:

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of not less than four academic years and has passed the prescribed examinations in all the four academic years.

R3.Branches of study in B.E.

BRANCH I	- Civil Engineering.
BRANCH II	- Civil and Structural Engineering.
BRANCH III	- Mechanical Engineering.
BRANCH IV	- Mechanical Engineering (Manufacturing).
BRANCH V	- Electrical and electronics Engineering.
BRANCH VI	- Electrical and Instrumentation Engineering.
BRANCH VII	- Computer Science and Engineering.
BRANCH VIII	- Chemical Engineering.
BRANCH IX	- Information Technology.
BRANCH X	- Electronics and Communication Engineering

R4.Subject of study:

The subjects of study are given in appendix I. The syllabus for the subjects is given in appendix II.

R5. Scheme of Examinations:

The scheme of Examinations is given in Appendix - I.

R6.Choice Based Credit System

Each course is normally assigned one credit per period of lecture/tutorial per week and one credits for two periods or part thereof for laboratory or practical or drawing per week.

Each semester curriculum shall normally have a blend of theory and practical courses. In the first year the total number of credits will be 32. For semesters III to VIII the average credits per semester will be 28 and total credits for the entire degree course will be 200. For the award of the degree a student has to

1. Earn a minimum of 200 credits,
2. Serve in the NSS or NCC for at least one year, and
3. Enroll as a student member of a recognized professional society.

R7.Duration of the programme

A student is normally expected to complete the B.E Mechanical programme in four years but in any case not more than seven years from the time of admission.

R8.Registration for courses

A newly admitted student will automatically be registered for all the courses prescribed for the first year without any option.

Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee will be done up to the last working day.

Registration for the project work shall be done only for the final semester.

R9.Assessment

The break-up of assessment and examination marks for theory subjects is as follows.

First assessment	: 15 marks
Second assessment (mid-semester test)	: 15 marks
Third assessment	: 10 marks
Examination	: 60 marks

The break-up of assessment and examination marks for practical subjects is as follows.

First assessment (test)	: 15 marks
Second assessment (test)	: 15 marks
Maintenance of record book	: 10 marks

Examination : 60 marks

The project work will be assessed for 40 marks by a committee consisting of the guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the chairman by the Head of the Department. The Head of the Department may himself be a member or the chairman. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

R10.Student Counsellors

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Head of the Department.

R11.Class Committee

For all the branches of study during the first year, a common class committee will be constituted by the Dean of the faculty.

From among the various teachers teaching the same common course to different classes during the first year, the Dean shall appoint one of them as course coordinator.

The composition of the first year class committee will be as follows.

Course co-ordinators of all common courses.
Teachers of all other individual courses.
All Heads of Departments, among whom one may be nominated as Chairman by the Dean.

The Dean may opt to be a member or the chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Heads of Departments.

The composition of the class committees from third to eighth semester will be as follows.

Course co-ordinators of the common courses, if any, who shall be appointed by the Head of the Department from among the staff members teaching the common course.

A project co-ordinator (in the eighth semester committee only) who shall be appointed by the Head of the Department from among the project supervisors.

Teachers of other individual courses.

One Professor or Reader, preferably not teaching the concerned class, appointed as chairman by the Head of the Department. The Head of the Department may opt to be a member or the chairman. All student counsellors of the class, and the Head of the Department (if not already a member) or any staff member nominated by the Head of the Department may opt to be special invitees.

The class committee shall meet four times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the first and third assessments and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The second assessment will be the mid-semester test. The third meeting will be held within a week after the second assessment is completed to review the performance and for follow-up action.

The fourth meeting will be held after all the assessments except the examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 40 marks will be finalised for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of first year) for approval and transmission to the Controller of examinations.

R12.Withdrawal from a course

A student can withdraw from a course at any time before a date fixed by the Head of the Department prior to the second assessment, with the approval of the Dean of the faculty on the recommendation of the Head of the Department.

R13.Temporary break of study

A student can take a one-time temporary break of study covering the current year/semester and/or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid semester test. However, the student must complete the entire programme within the maximum period of seven years.

R14.Movement to higher semesters

The following minimum credits must be earned by the student to move to a higher semester.

To move to the fourth semester	: 25 credits
To move to the fifth semester	: 50 credits

To move to the sixth semester	: 75 credits
To move to the seventh semester	:100 credits
To move to the eighth semester	:125 credits

The result of the eight semester will be withheld until the student passes all the previous semester examinations.

A student who has not fulfilled the NCC/NSS requirements will not be eligible to register for the fifth semester.

R15.Substitute assessments

A student who has missed, for genuine reasons accepted by the Head of the department, one or more of the assessments of a course other than the examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the fourth meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

R16.Attendance requirements

To be eligible to appear for the examination in a particular course, a student must put in a minimum of 80% of attendance in that course. However, if the attendance is 75% or above but less than 80% in any course, the authorities can permit the student to appear for the examination in that course on payment of the prescribed condonation fee.

A student who withdraws from or does not meet the minimum attendance requirement in a course must re-register for and repeat the course.

R17.Passing and declaration of examination results

All assessments of all the course on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average and cumulative grade point average, and prepare the grade cards.

90 to 100 marks	: Grade 'S'
80 to 89 marks	: Grade 'A'
70 to 79 marks	: Grade 'B'
60 to 69 marks	: Grade 'C'
55 to 59 marks	: Grade 'D'
50 to 54 marks	: Grade 'E'
Less than 50 marks	: Grade 'F'
Insufficient attendance	: Grade 'I'
Withdrawn from the course	: Grade 'W'

A student who obtains less than 24 marks out of 60 in the examination or is absent for the examination will be awarded grade 'F'.

A student who earns a grade of S,A,B,C,D or E for a course is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who obtains letter grade F in a course has to reappear for the examination in that course.

A student who obtains letter grades I or W in a course must reregister and repeat the course.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; F – 0

Courses with grades I and W are not considered for calculation of grade point average or cumulative grade point average. F grade will be considered for computing GPA and CGPA.

A student can apply for retotalling of one or more of his examination answer papers within a week from the date of issue of grade sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of examinations with the recommendation of the Head of the Department.

After results are declared, grade cards will be issued to the students. The grade card will contain the list of course registered during the year/semester, the grades scored and the grade point average(GPA) for the year/semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the year/semester, divided by the sum of the number of credits for all courses taken in that year/semester. CGPA is similarly calculated considering all the courses taken from the time of admission.

The results of the final semester will be withheld until the student obtains passing grade in all the subjects of all earlier semesters.

After successful completion of the programme, the degree will be awarded with the following classifications based on CGPA.

For First class with Distinction the student must earn a minimum of 200 credits within four years from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First class the student must earn a minimum of 200 credits within five years from the time of admission and obtain a CGPA of 6.75 or above.

For Second class the student must earn a minimum of 200 credits within seven years from the time of admission.

R18.Ranking of candidates:

The candidates who are eligible to get the B.E. degree in First Class with distinction will be ranked together on the basis of the percentage of marks obtained by them in all the subjects of study from III to VIII semester.

The candidates passing with First class will be ranked next after those with distinction on the basis of the percentage of marks obtained by them in all the subjects of study from III to VIII Semester.

The ranking will be done separately for each branch of study.

R19.Electives

Apart from the various elective courses offered in the curriculum of the branch of specialisation, a student can choose a maximum of two electives from any specialisation under the faculty during the entire period of study, with the approval of the Head of the Department and the Head of the Department offering the course.

R20. The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the subjects of study and the syllabi from time to time.

R21. Transitory Regulations

Wherever there had been change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendations of the Head of the Department concerned.

SUBJECTS OF STUDY AND SCHEME OF EXAMINATIONS

BACHELOR OF ENGINEERING (MECHANICAL) – FULL-TIME
(4 Year Degree Course)
CHOICE BASED CREDIT SYSTEM (CBCS)

FIRST YEAR

Course Code	Course	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
101	Technical English	3	--	--	--	3	40	60	100	3
102	Engineering Mathematics-I	3	1	--	--	3	40	60	100	4
103	Engineering Physics	3	--	--	--	3	40	60	100	3
104	Engineering Chemistry	3	--	--	--	3	40	60	100	3
105	Engineering Mechanics	3	--	--	--	3	40	60	100	3
106	Basic Engineering (Civil, Mechanical & Electrical)	6	--	--	--	3	40	60	100	3
107	Environmental Studies	3	--	--	--	3	40	60	100	3
108	Engineering Drawing	--	--	--	3	3	40	60	100	2
109	Physics Laboratory	--	--	3	--	3	40	60	100	2
110	Chemistry Laboratory	--	--	3	--	3	40	60	100	2
111	Computer Programming	1	--	2	--	3	40	60	100	2
112	Workshop Practice	--	--	3	--	3	40	60	100	2
	Total	25	1	11	3		480	720	1200	32

Cumulative: 32

L – Lecture T – Tutorial P – Practical D – Drawing

THIRD SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
MEEC 301	Engg.Mathematics – II	4	--	--	--	3	40	60	100	4
MEEC 302	Engineering Mechanics-Dynamics	4	--	--	--	3	40	60	100	4
MEEC 303	Thermodynamics	4	--	--	--	3	40	60	100	4
MEEC 304	Mechanics of Materials	4	--	--	--	3	40	60	100	4
MEEC 305	Electrical & Electronics Engg.	4	--	--	--	3	40	60	100	3
MEEC 306	Mech. Measurements and Control	4	--	--	--	3	40	60	100	4
MEEP 307	Machine Drawing	--	--	2	4	3	40	60	100	3
MEEP 308	Mechanical Engg. Lab-I	--	--	6	--	3	40	60	100	3
MEEP 309	Programming Laboratory	--	--	3	--	3	40	60	100	2
	Total	24	--	11	4		360	540	900	31
								Cumulative		63*

*Includes 32 credit points in first year

FOURTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
MEEC 401	Probability and Statistics	4	1	--	--	3	40	60	100	4
MEEC 402	Heat Engineering - I	4	--	--	--	3	40	60	100	4
MEEC 403	Fluid Mechanics	4	--	--	--	3	40	60	100	4
MEEC 404	Machine Design – I	4	--	--	--	3	40	60	100	4
MEEC 405	Mechanics of Machines-I	4	--	--	--	3	40	60	100	4
MEEC 406	Production Tech. – I	4	--	--	--	3	40	60	100	4
MEEP 407	Electrical Lab.	--	--	3	--	3	40	60	100	2
MEEP 408	Workshop Practice-II	--	--	4	--	3	40	60	100	2
	Total	24	1	7	--		320	480	800	28
								Cumulative		91

FIFTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
MEEC 501	Numerical Methods	4	--	--	--	3	40	60	100	4
MEEC 502	Mechanics of Machines-II	4	--	--	--	3	40	60	100	4
MEEC 503	Heat engineering – II	4	--	--	--	3	40	60	100	4
MEEC 504	Hydraulics and Pneumatics	4	--	--	--	3	40	60	100	4
MEEC 505	Machine Design - II	4	--	--	--	3	40	60	100	4
MEEC 506	Production Tech. – II	4	--	--	--	3	40	60	100	4
MEEC 507	Industrial Engg. & Mgt.	4	--	--	--	3	40	60	100	4
MEEP 508	Civil Engg. Laboratory (A) S.M Laboratory (B) Hydraulics Lab. (Equal weightage)	--	--	4	--	3	40	60	100	2
	Total	28	--	4	--		320	480	800	30
								Cumulative		121

SIXTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
MEEC 601	Power Plant Engineering	4	--	--	--	3	40	60	100	4
MEEC 602	Engineering Metallurgy	4	--	--	--	3	40	60	100	4
MEEC 603	Automotive Engineering	4	--	--	--	3	40	60	100	4
MEEC 604	Operations Research	4	--	--	--	3	40	60	100	4
MEEC 605	Refrigeration & Air conditioning	4	--	--	--	3	40	60	100	4
MEEC 606	Turbomachinery	4	--	--	--	3	40	60	100	4
MEEP 607	Workshop Practice – III	--	--	6	--	3	40	60	100	2
MEEP 608	Mechanical Engg. Lab-II	--	--	5	--	3	40	60	100	3
	Total	24	--	11	--		320	480	800	29
								Cumulative		150

SEVENTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration Of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
MEEC 701	Heat and Mass Transfer	4	--	--	--	3	40	60	100	4
MEEC 702	Finite Element Analysis	4	--	--	--	3	40	60	100	4
MEEC 703	Renewable Energy Sources	4	--	--	--	3	40	60	100	4
MEEE 704	Elective – I	4	--	--	--	3	40	60	100	4
MEEE 705	Elective – II	4	--	--	--	3	40	60	100	4
MEEP 706	Mechanical Engg.Lab-III	--	--	3	--	3	40	60	100	4
	Project work	--	--	2	--					
	Seminar	--	--	2	--					
	Total	20	--	7	--		240	360	600	24
							Cumulative			174

EIGHTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration Of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
MEEC 801	CAD/CAM/CIM	4	--	--	--	3	40	60	100	4
MEEC 802	Mechatronics	4	--	--	--	3	40	60	100	4
MEEC 803	Ethics in Engineering	4	--	--	--	3	40	60	100	4
MEEE 804	Elective – III	4	--	--	--	3	40	60	100	4
MEEE 805	Elective – IV	4	--	--	--	3	40	60	100	4
MEET 806	Project work	--	4	--	--					
	Viva Voce	--	--	--	--		40	60	100	6
	Seminar	--	2	--	--					
	Total	20	6	--	--		240	360	600	26
							Cumulative			200

L – Lecture T – Tutorial P- Practical D-Drawing

SYLLABI FOR THE SUBJECTS

MEEC-301-ENGINEERING MATHEMATICS - II

OBJECTIVES

The course aims to develop the skills of the students in engineering mathematics. They will be trained on the basics of chosen topics of mathematics namely Fourier series, partial differential equations, Fourier transform. The above topics introduced in this course will serve as basic tools for specialized studies in fields like Fluid mechanics, Circuit theory and Communication engineering.

.UNIT-I: Partial Differential Equations

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Solution of standard type of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients.

UNIT-II: Fourier Series

Dirichle's conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval's identity.

UNIT-III: Boundary value problems

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

UNIT-IV: Fourier Transform

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's identity

UNIT-V: Z – Transform and difference equations

Z – transform – Elementary properties – Inverse Z – transform - Convolution theorem – Solution of difference equations using Z – transform.

Text Books

1. Kandasamy.P , Tilagavathy.K and Gunavathy.K, Engineering Mathematics ,6th ed., (Vol-I & II) S.Chand & Co Ltd. 2006, New Delhi.
2. Ventakataraman M.K., Engineering Mathematics - The National Publishing Co., Chennai, 2003.

Reference Books:

1. Veerarajan T, Engineering Mathematics , 3 rd edition, 2005, Tata McGraw Hill Pub...
2. Singaravelu . A , Engineering Mathematics , Meenakshi Publications, Chennai,2004.

MEEC302 ENGINEERING MECHANICS - DYNAMICS

OBJECTIVES

At the end of this course the student should be able to understand the kinematics and kinetics and both rectilinear and curvilinear motions, concept of work-energy and impulse momentum principles. He should be able to comprehend the loss of motion and able to write the equations of dynamic equilibrium. All these should be achieved both conceptually and through solved examples.

Unit - I

Kinematics of particle - Kinematics of rectilinear motion – motion of bodies with constant acceleration - motion of bodies falling freely – motion of bodies projected vertically upwards – motion with variable acceleration - composition of displacements, resolution of velocities – polygon of velocities – relative velocity

Unit - II

Kinematics of curvilinear motion – normal & tangential components of acceleration- motion of particle in a plane – motion of a projectile – equation of the path – expression for time of flight, height, range and angle of projection – projection on an inclined plane – motion along a circle.

Unit - III

Kinetics of particles – kinetics of rectilinear motion - D'Alembert's principle – Motion of a lift – motion over a smooth pulley- motion of two masses connected by a string – kinetics of curvilinear motion – centrifugal force – angular momentum – rotation – centroidal rotation – super elevation – motion of a vehicle on a circular path – maximum speed to avoid over turning and skidding.

Unit - IV

Kinetics of particle - Work and energy – work done by a force – relation between work and kinetic energy for rectilinear translation – work done by a couple or torque – relation between work and kinetic energy for plane motion – principle of conservation of energy - power.

Unit – V

Impulse and momentum – relation between impulse and momentum for rectilinear translation – conservation of linear momentum– angular impulse and angular momentum – conservation of angular momentum. – Collision of elastic bodies – impact – direct and oblique impact – coefficient of restitution – loss of kinetic energy during impact.

Textbooks:

1. Engineering Mechanics by Dr. Sadhu Singh, Oxford & IBH Publishing Co.
2. Engineering Mechanics by Dr. A.K. Tayal, Umesh Publications

Reference books:

1. Engineering Mechanics (Statics and Dynamics) by Mclean and Nelson (Schaum's Outline Series) McGraw-Hill Book Company
2. Engineering Mechanics by Irving H. Shames, Prentice-Hall of India, 4th ed., 2004.
3. Engineering Mechanics by R.C. Hibbeler, Macmillan Publishing Company, INC (Dynamics)
4. Vector Mechanics for Engineers by Beer and Johnston, McGraw-Hill Book Company, 2007
5. Engineering Mechanics by R.S. Khurmi, S.Chand & Company Ltd, 20th ed., 2006.
6. Engineering Mechanics (Dynamics) by V. Sundararajan, Tata McGraw-Hill Publishing Limited
7. Engineering Mechanics by K.L Kumar,Tata McGraw-Hill Publishing Limited
8. Dynamics by S. Narayanan, S.Chand and Co.,

MEEC303 THERMODYNAMICS

OBJECTIVES

To understand the principles and analysis of Thermodynamic and bulk behavior of simple physical systems.

UNIT-I

Fundamental concepts and definitions - Thermodynamic system - State, property of system - Thermodynamic equilibrium - Zeroth law - temperature scales - path, process, cycle - work and heat.

First law of Thermodynamics - Mechanical equivalent of heat - Corollaries of the First law - Internal energy - steady flow energy equation.

Second law of Thermodynamics - Limitations to the First law - heat engine and reversed heat engines - Kelvin Planck and Clausius statements - corollaries - reversibility - Car not cycle - Thermodynamic temperature scale - Entropy - Clausius inequality.

UNIT- II

Properties of pure substance- Tables of properties - Diagrams of properties - representation on p-V, T-s and h-s diagrams.

Non-flow processes - Constant volume - constant pressure - isothermal - isentropic and polytrophic processes for gas and vapor - Representation on p-V and T-s diagrams - Flow processes - Constant pressure - isentropic - polytrophic - throttling using gas and vapor - work and heat exchange - representation on p-V and T-s diagrams

UNIT- III

Gas cycles - Carnot, Otto, Diesel, Dual and Brayton cycles - representation on p-V and T-s diagrams - Air standard efficiency - mean effective pressure.

UNIT- IV

Vapour cycle: Carnot cycle with steam as working substance - Rankine cycle - Efficiency of these cycles - representation on T-s and h-s diagrams - Reheat cycle - specific steam consumption and work ratio-Regeneration(Concept only)

UNIT- V

Gas and gas-vapour mixtures - Dalton's law – Amagat's law - properties of air and water vapour mixtures - Psychrometric chart - Psychrometric calculations.

Text Books:

1. Ballaney P.L., Thermal Engineering, Khanna Publishers, New Delhi,24th ed.,2003.
2. Nag P.K., Engineering Thermodynamics, Tata McGraw-Hill, New Delhi, 4th ed., 2008
3. Gorden J. Van Wylen & Richars E. Sonntag, Fundamentals of Classical Thermodynamics, John Wiley & Sons, 1985.

Reference Books:

1. Dr.C.G. Saravanan & M.P. Ashok, Thermodynamics, Scitech Publications, 2008.
2. Patel R.C. & Patel A.A., Applied Thermodynamics
3. Gupta C.P. & Prakash, Engineering Thermodynamics
4. Spalding and Cole, Engineering Thermodynamics, ELBS.

MEEC 304 MECHANICS OF MATERIALS

OBJECTIVES

To gain knowledge of simple stresses, strains and deformation in components due to external loads.

To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.

Effect of component dimensions and shape on stresses and deformations are to be understood. The study would provide knowledge for use in the design courses

UNIT- I

Elementary ideas about stress and strain - Mechanical properties of Engineering materials - Hardness and impact tests - Classification of loads - static, dynamic and impact loading - Concepts of stress and strain - stress-strain diagrams for brittle and ductile materials - Luders lines - Hookes law – true stress- true strain - shear stress - shear strain – Poisson's ratio and elastic constants.

UNIT- II

Principal stress and principal strain - triaxial stresses - strain energy and work done in tension and compression - stress in compound bars - temperature stresses - stress concentration.

UNIT- III

Bending moments and shearing forces under dead loads - cantilevers - simply supported and overhanging beams with different types of loading - bending moment and shear force diagrams - maximum bending moment - maximum shear force - Point of inflexion - Bending stress in beams - simple theory of bending stress in beams of varying sections - stresses in composite sections - moment of resistance - beams of uniform strength.

UNIT- IV

Deflection of Determinate beams - Determination of elastic curve - Double integration method, Macaulay's method - Area moment methods - strain energy - The theorem of Castingliano.

UNIT- V

Theory of columns- Eulers theory for long columns – Rankine's formula – Johnson's formula – Columns subjected to eccentric loading – Torsion of shafts – Theory of pure torsion – Power transmitted by a shaft – torsional rigidity – Helical springs – Open and close coiled – Laminated springs.

Text Books:

1. Junarkar S.B. & Shah H.J., Applied Mechanics, Charotar Pub. House, Anand, 1994.
2. Ramamirutham S, Strength of Materials, Dhanpat Rai & Sons, New Delhi, 1995.
3. Khurmi R.S., Strength of Materials, S.Chand & Co., New Delhi, 23rd ed.,2005.
4. Timoshenko S. & Young D.H., Strength of Materials, East West Press, New Delhi, 1968.

Reference Books:

1. Papov, Mechanics of Materials.
2. Etan, Mechanics of Materials.

MEEC305 ELECTRICAL & ELECTRONICS ENGINEERING

OBJECTIVES

To impart a sound understanding of the principles of electrical and electronics engineering with an emphasis on concepts and quantitative approach.

UNIT I

D.C Motors – Principles of operation – back emf – lap and wave windings – commutator – speed and torque equations – methods of speed control – speed torque characteristics of series, shunt and compound motors – efficiency – swinburne's test – applications of d.c. motors – starters – necessity and use - types of starters and connections.

UNIT II

Transformer – working principle – phasor diagram for no load and loaded conditions – equivalent circuit – O.C and S.C tests – efficiency and voltage regulation – Auto transformer – Three phase transformers – constructional features – connections – line voltage and current relations.

UNIT III

Three – Phase induction motors – types – principle of operation – rotating magnetic field – synchronous speed and slip - equivalent circuit – torque slip characteristics – starters – single phase induction motors – principle of operation – types – starting methods – applications.

Alternators – principle of operation and constructional features – salient and non-salient pole machines – voltage regulation – emf method – synchronous motors – phasor diagram – power factor control – applications.

UNIT IV

P-N Junction – characteristics and uses of semi conductor devices: diode, photo diodes, zener diodes, BJT, FET, UJT & SCR, rectifier circuits – Half wave, full wave and bridge – filters – zener voltage regulators

UINT V

Transistorized amplifiers and oscillators: Classification and characteristics – Voltage, current and power gain – frequency response – Audio amplifier – principle of negative feedback – emitter follower – power amplifier – class A,B,C – applications – oscillators – R C phase shift – Hartley and UJT oscillators.

Text Books:

A Text Book of Electrical Technology, Theraja B.L., S. Chand & Co., New Delhi , Vol.I, 24th ed.2005 and Vol.II 23rd ed.2005.

Reference Books:

1. A Text Book of Electrical Machines, Rajput R.K., Lakshmi Publications., 1988
2. Principles of Electronics, Mehta V. K., S. Chand & Co., New Delhi, 9th ed.,2004.

MEEC306 MECHANICAL MEASUREMENTS AND CONTROL

OBJECTIVES

To understand the principles of metrology and measurements, methods of measurement and its application in pressure, temperature, strain measurement, etc.,

To study the different types of control systems and stability analysis of control systems.

UNIT - I

Generalised measurement system - Basic standards of measurement - Errors - classification.

Measurements of displacement force and torque Dynamometers: Hydraulic, Absorption and eddy current.

UNIT - II

Measurement of strain - Bonded and Unbounded strain gauges - Requirements of materials. Mechanical - Electrical - Opto mechanical strain gauges.

Measurement of temperature - electrical and non-electrical methods - Bimetallic and pressure thermometer thermocouples - requirements - Resistance thermometers - pyrometry - Calibration methods.

UNIT - III

Measurements of pressure and flow - measurements of high pressure and low pressure - measurements of flow by obstruction meters - velocity probes - Hot wire anemometer - Calibration of pressure gauges and flow meters - Time constant of pressure gauges.

UNIT -IV

Elementary ideas of automatic control. Open and Closed systems. On-off, Proportional, and floating modes reset and rate actions. Combined modes for pneumatic, hydraulic and electrical systems.

UNIT -V

Transfer function - stability - Routh's criterion - Analysis of second order systems - system response to step - step pulse - ramp inputs.

Introduction to computerized measurement and control systems (Description only)

Text Books:

1. Hollman.J.P Experimental methods for Engineers, Tata McGraw –Hill, 7th ed., 2007
2. Benjamin Kuo: Automotive Control Engineering, EEE Publications.

Reference Books:

1. Beckwith, T.C & Buck, N.L.: Mechanical Measurements, Addison Wesley
2. Nagarth and Gopal: Control Engineering, Wiley Eastern Ltd.
3. Control system by Nagoor kani.RBA pub.,Chennai,2000.

MEEP 307 MACHINE DRAWING

OBJECTIVES

To introduce to the students the importance of machine drawing in engineering applications
To train the students in free hand sketching of machine components
To impart the knowledge of assembly drawing and production drawing of machine Components

UNIT- I

Free Hand Sketches:

Fasteners: Different form of rivet heads - single and double riveted lap and butt joints - Foundation bolts - Locking arrangements for nuts - lock nut, split pin, castle nut, grooved nut, locking plate and spring washer - Stud - Drilled and Tapped holes - Set screws - Different forms of machine screws - pan, countersunk, slotted, fillister and philip headed screws - Keys - sunk taper key, gib headed taper key, feather key, woodruff key, saddle key - C.I.pulleys - Belt pulleys, fast and loose pulley, stepped cone pulley and V-Belt pulley.

Couplings and joints:

Shaft coupling - muff coupling, flanged coupling, socket and spigot joint - Ball and roller bearing - Pipe joints - Flanged joint for C.I.pipes.

UNIT- II

Orthographic and Assembly drawings.

To draw orthographic views from the given isometric views of simple objects. Detailed assembly drawing and additional views from the given drawing.

(a) Shaft coupling - Protected type and Pin type flexible coupling
(b) Bearings and Supports - Bushed bearing, Foot step bearing and Plummer Block
(c) Eccentric
(d) Steam Engine stuffing box
(e) Screw Jack.

Production Drawings:

(a) Side crank
(b) Petrol engine connecting rod
(c) Universal coupling
(d) Revolving centre

CAD to be included (not for examination)

Text Books:

1. Bhatt N.D., Machine Drawing, Charotar pub.house, 39th ed., 2004.
2. Gopalakrishna K.R., Machine Drawing, Subhas stores, Bangalore.

Reference Books:

1. Parkinson A.C.(Sinha), A First Year Engineering Drawing, Wheeler Publishers, New Delhi, 1993.
2. Parkinson A.C., Intermediate Engineering Drawing,
3. Narayana K.L., Kanniah P & Venkata Reddy K., A text book on Production Drawing, Premier Publishing House, Hydrabad, 1997.
4. Narayana K.L., Kanniah P. & Venkata Reddy K., Machine Drawing,Wiley Eastern Ltd., 1995.
5. Lakshmi Narayanan V & Mathur M.L., A Text Book of Machine Drawing, Jain Bros., New Delhi -13th ed.2001.

MEEP308 MECHANICAL ENGINEERING LABORATORY - I

OBJECTIVES

To study the components of I.C. engines, boilers, steam turbines and steam engines.
To train the students in the various aspects of measurements like calibration, time constant, dynamic error, etc.,

- - -

Experiments in I.C.Engines, Steam, Fuels & Combustion and Measurements & Controls laboratories.

The syllabi for the above laboratory will be suitably and appropriately framed by the Head of the Department from time to time depending on textual background, availability of machines and any future infrastructural development.

- - -

MEEP309 PROGRAMMING LABORATORY

OBJECTIVES

To make the students understand the concept of local area network and its management
To provide hands-on experience in C and C++ programming

- - -

LAN introduction - File server - Nodes - Sharing the Resources - System Configuration - Some important Netware Commands - Login and logout

Exercise to compile, link and run C and C++ programs - Invoking Turbo C++ -Details of the IDE screen - Main menu - Editor window, message window - Status line - Explanation - Creating source file - Compiling, linking and running - Managing errors - Handling an existing file under DOS prompt and under IDE - Shortcuts using function keys.

- - -

MEEC401 PROBABILITY AND STATISTICS

OBJECTIVES

At the end of the course, the students would acquire skills in handling situations involving more than one random variable and functions of random variables.

Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.

Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

UNIT-I: Probability and Random variables

Definition - Type of random variables - Probability distribution function - Probability density function - Expectation and moments - Moment generating functions - Characteristics function - Joint probability distribution - Joint cumulative distribution function - Marginal probability distribution function – Conditional probability density function – Transformation of random variables.

UNIT-II: Random processes

Classification of random processes – Method of description of random process – Special classes of random processes – Average value random processes – Stationary – Analytical representation of random process – Auction correlation function and its properties – Properties of R(t) – Cross correlation and its properties.

UNIT-III: Test of significance

Hypothesis testing – Large sampling test – Small sampling tests based on t,F and Chisquare distributions , interval estimates of mean, Standard deviation and proportion.

UNIT-IV: Design of experiments and Statistical quality control

Basic principle of experimental design – Completely randomized design – Analysis of variance for one way classification or one factor experiments – Randomized block design – Analysis of variance for one way classification or one factor experiment – Latin square design – Analysis of variance for three factor experiments – RDB and LSD comparison.

Basics of control charts – Control charts for variables.

UNIT-V : Reliability Engineering

Definition of Reliability - Hazard rate and mean time to failure - Exponential and Weibull failure models - system reliability - series system, parallel system.

Text Books:

1. Veerarajan.T,Probability statistics and Random process, Tata McGraw Hill, New Delhi,3rd ed.,2008.
2. Kandasamy.P , Tilagavathy.K and Gunavathy.K, probability and statistics and queuing theory , S.Chand & Co Ltd. 2nd ed.2005, New Delhi.

Reference Books:

1. Ross.S , A first course in probability, Pearson Education, New Delhi,2002.
2. Gupta S.C. and Kapur J.N.-Fundamentals of Mathematical Statistics, Sultan Chand and sons, Delhi,1996.

MEEC402 HEAT ENGINEERING - I

OBJECTIVES

To apply the thermodynamic concepts into various thermal application like IC engines Steam engines and Compressors.

UNIT- I

Reciprocating compressors- work transfer in reversible reciprocating machines - indicator diagram - single stage and multistage compression - intercooling - calculation of main dimensions - effect of clearance volume -volumetric efficiency.

UNIT- II

Steam engines - cycle of operation - Piston valve and Mayer expansion valve - mechanical, thermal, Rankine and overall efficiencies - missing quantity - Willan's line - method of compounding - advantages.

UNIT- III

Reciprocating internal combustion engines - working of two stroke and four stroke engines - working of simple carburettor - diesel injection pump and atomiser - comparison of actual cycles with air standard cycles - lubrication and cooling system - Scavenging and Supercharging.

UNIT- IV

Combustion in S.I. and C.I. Engines - Fuel air mixture requirement - combustion chambers - basic requirements - detonation and knocking - antiknock additives - evaluation of performance.

UNIT- V

Performance of I.C.Engines - load test - speed test - Morse test - heat balance test - power developed in an engine - measurement of indicated power - engine indicators - brake power - volumetric and various efficiencies of I.C. Engines - Problems.

Text Books:

1. Ballaney P.L., Thermal Engineering, Khanna Publishers, New Delhi, 24th ed.2003.
2. Khurmi R.S., Thermal Engineering, S.Chand & Co., New Delhi.14th ed.2005

Reference Books:

1. Mathur & Sharma: A Text Book on Internal Combustion Engine

MEEC403 FLUID MECHANCIS

OBJECTIVES

To understand the structure and the properties of the fluid.

To analyze and appreciate the complexities involved in solving the fluid flow problems.

To study the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.

To understand the energy exchange process in fluid mechanics handling incompressible fluids.

UNIT-I

Fluid properties -Pressure in a fluid - Static fluid in a gravitational field - Pressure-height relation for incompressible fluid - Manometers, total force on a plane submerged area - forces in irregular surfaces - Buoyancy and static stability - Pressure-height relation in compressible fluids.

UNIT-II

Kinematics of Fluid Flow:

Path line and stream lines - One dimensional flow analysis - equation of continuity - steady flow equation of continuity - unsteady flow - velocity distribution - Euler's equation for frictionless fluid and Bernoullis equation.

UNIT-III

Boundary layer - Laminar - Turbulent flow - separation - Transition between Laminar and Turbulent flow - free and forced vortex flow(Theory only) - smooth and rough pipes - frictional loss in circular and noncircular pipes. Losses due to sudden enlargement - Diffusers.

UNIT-IV

Buckingham's theorem - Physical significance of dimensionless numbers - Mach number - Reynold's number - Froude number and Weber number.

UNIT-V

Flow of Compressible fluids:

Velocity of sound, physical difference between subsonic and supersonic flow - Mach cone and Mach angle - Stagnation properties - One dimensional compressible flow - Isentropic flow Elementary ideas of Rayleigh and Fanno lines and normal shocks (Description only)

Text Books:

1. Bansal R.K., A Text Book of Fluid Mechanics and Hydraulic Machinery,9th ed., Laxmi Publication, New Delhi, 2005.
2. Zayal and Humain, Gas Dynamics.

Reference Books:

1. Dr.P.N.Modi and Dr.S.M.Seth, Hydraulics and Fluid Mechanics, Standard Book House, 16th ed., 2007.
2. Khurmi R.S., Hydraulics, Fluid mechanics and hydraulic Machines, S.Chand and Company Ltd., New Delhi, 19th edition ,2005.
3. Dr.Jagdish Lal, Fluid Mechanics and Hydraulic Machines, Metropolitan Book Co. Pvt.Ltd., New Delhi, 1998.
4. Frank M. White, Fluid Mechanics, McGraw Hill,6th ed.,2007.

MEEC404 MACHINE DESIGN – I

(Use of approved Design Data Book is permitted in the Examination)

Objectives

To familiarize the various steps involved in the Design Process

To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.

To learn to use standard practices and standard data

To learn to use catalogues and standard machine components

UNIT - I

Introduction: Types of Design factors. Factor of safety , Theories of failure - Curved beam, crane hook and C frames.

Design for fatigue strength: S-N diagram - Endurance limit modifying factors - Stress concentration - Fluctuation stress - Soderberg & Good Man equations.

UNIT - II

Shafts - Material and design stresses - Calculation of equivalent bending moment and twisting moment - Design of shafts subjected to combined bending moment and twisting moment.

Design of leaf springs - construction equalized stresses in leaves - material and design. Design of helical springs stress - Wahl's factor.

UNIT - III

Theory of columns: Design of push rod, piston rod and I.C. Engine connecting rods sections.

Wire ropes - Stresses - selection Design procedure.

UNIT - IV

Coupling - Types - Design and selection of coupling - Flange coupling, Bushed pin type, flexible coupling design and selection.

Power screws - Thread forms Design consideration and materials - wear and shear - design procedure.

UNIT - V

Design of Joints:

Riveted Joints: Introduction - Types of riveted joints - failures of a riveted joint - strength and efficiency - Design of boiler joints.

Welded joints: Introduction - Strength of transverse and parallel fillet welded joints - Axially loaded unsymmetrical welded sections - Eccentrically loaded welded joints.

Text Books

1.Machine Design - Khurmi R.S., S.Chand and Company Ltd., New Delhi, 14th edition, 2005.

2.Machine Design – Pandya and Sha., Charotar pub. house, Anand , India

Reference Books:

1. Mechanical Engineering Design: Richard Budynnas, J.E.Shigley's - McGraw Hill Book Company,8th ed.,2008

2. Fundamentals of Machine Design - T.J.Prabhu, 4th ed. 2000, Scitech pub.

3. Machine Design - T.V.Sundararajamoorthy & N.Shanmugam - Anuradha agencies.2000.

MEEC405 MECHANICS OF MACHINES - I

OBJECTIVES

To understand the layout of linkages in the assembly of a system/machine.
To study the principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism
To analyse the motion resulting from a specified set of linkages in a mechanism.
To study the application of friction in clutches.
To study the use of belt, ropes and gears in power transmission
To study the use of gyroscopic couples and theory of lubrication.
To understand the principles in mechanisms used for governing of machines.

UNIT - I

Kinematics - links, pairs chain and mechanism- inversion - Mechanisms obtained by inversion.

Velocity and acceleration of simple mechanisms by relative velocity method.-Klein's construction for slider-crank chain

UNIT-II

Friction - clutches - single plate, multi plate and cone clutches.

Belt and rope drives - Tension due to centrifugal force - Maximum power transmitted - chain drive - brakes

Lubrication - Theory of Lubrication - properties of lubricants - Hydrodynamic and hydrostatic bearing - frictional loss of power in journal, pivot and collar bearings.

UNIT-III

Cams-Layout of cam profile for uniform velocity, simple harmonic, cycloidal and uniform acceleration and retardation with reciprocating and oscillating followers of different types Knife edged, roller and flat - Calculation of maximum velocity and acceleration of followers.

Gyroscopic couple - applications to ship, motor cycle, air crafts and automobiles.

UNIT - IV

Gears - Fundamental law of toothed gearing - length of path of contact-interference

Gear trains-types-speed calculation in epicyclic gear trains.

UNIT - V

Governors-function of governors-Porter, Proell and spring loaded governors- stability and isochronism-effect of friction

Calculation of equilibrium speeds and range of speed of governors.

Text Book:

1. Theory of Machines by Abdulla Sheriff, Dhanpat Rai, New Delhi,2006.

Reference Books:

1. Theory of Machine : Thomas Bevan , CBS publishers, 2001.
2. Theory of Machine: P.L.Ballaney , Khanna Publications, New Delhi.23rd ed,. 2003.
3. Theory of Machine: L.Toft and A.T. Kersay, Pitman Publishers.
4. Theory of Machines: W.C. Green, Blackie Publications.
5. Theory of Machines: Khurmi R.S., Eurosia Publications, New Delhi.1998

MEEC406 PRODUCTION TECHNOLOGY - I

OBJECTIVES

To understand the concept and basic mechanics of foundry, metal forming, metal joining, metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching

To understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.

UNIT- I Foundry

Use of Patterns - types - constituents of moulding sand - sand moulding methods - use of cores - principles of die casting, centrifugal casting, investment casting and shell moulding.

UNIT- II Metal Forming

Hot and Cold working - principles of forging, rolling and extrusion processes - conditions for yielding of metals - stress- strain relations in elastic and plastic deformations- Basics of explosive forming.

Types of presses - drive arrangement - operations - press tools.

UNIT- III Welding

Oxy-acetylene gas welding - types of flames and their uses - principles of arc welding, resistance welding - TIG and MIG welding and atomic hydrogen welding - Basics of explosive welding - soldering and brazing.

UNIT- IV Machine tools-I : Lathe, shaper, Planner and Slotter Lathes: Specifications of centre lathe - operations performed - accessories and attachments - principle of capstan and turret lathes - layout of tools.

Shaper, Planner and slotter -General arrangement - principle of operation - drive mechanisms.

UNIT- V Machine tools-II : Milling, Drilling, Boring and Sawing Milling Machines: Types and specification - operations - types of cutters - attachments and accessories - examples of work.

Drilling and Boring: Types and specifications of drilling machines - operations - accessories and attachments - types of boring machines - jig boring.

Sawing: Power saws - types and principle of operation.

Text Books:

1. Hajara Chowdry et al.: Elements of Workshop Technology Vol.I & Vol.II ,Media promoters & pub.,1997.
2. Khanna O.P. & Lal M, Production Technology Vol.I & Vol.II, Dhanpat Rai & Sons.2000.

Reference Books:

1. Chapman W.A.J., Workshop Technology Vol.I, II & III, CBS pub. 2001
2. Begeman, Manufacturing Processes
3. Dieser, Mechanical Metallurgy
4. Paul De Garnes, Materials and Process in Manufacturing
5. Zinberg R.A., Process and Materials of Manufacturing

MEEP407 ELECTRICAL LABORATORY

OBJECTIVES

To understand the theoretical and practical aspects of electrical equipments through a variety of experiments.

The syllabus is to cover experiments in the theory syllabus under MEEC 305. The experiments will include D.C. & A.C machines, energy meters and electronic devices including amplifiers.

MEEP408 WORKSHOP PRACTICE - II

OBJECTIVES

To impart practical training to the students on various welding processes

To develop procedural and manual skills in machining and also to provide training in making greensand moulds

To give practical training on sheet metal works

\- - -

Welding and Joinery:

Electric, arc and gas welding - electrodes and filling materials - fluxes - types of welds and welded joints - welding positions.

Foundry:

Hand tools, moulding sands, pattern, types, materials and allowances, moulding methods, uses of gates, risers and runners, cores, chaplets, fettling and finishing casting defects.

Machine Tools:

Use of centre lathe and bench drilling machine, simple turning operations - Cylindrical, taper turning, external threading and knurling.

Sheet Metal Works:

Simple exercises like funnel and tray.

MEEC501 NUMERICAL METHODS

OBJECTIVES

To develop the skills of the students in numerical mathematics. They will be trained on the basics of chosen topics. Numerical mathematics namely method of finite difference interpolation, numerical solution of algebraic and transcendental equations, numerical solution of ordinary and partial differential equations. At the end of the course the students would have a well-founded knowledge to solve applied problems in all branches of engineering.

UNIT-I

Method of finite differences: Finite difference operators - Solution of first and second order linear difference equation with constant coefficients non-homogeneous linear difference equations with constant coefficients.

UNIT-II

Interpolation - Newton - Gregory forward and backward, interpolation - Newtons divided difference formula - Lagrange's interpolation formula for unequal intervals - Gauss interpolation formula - Stirling interpolation formula - Numerical differentiation - Numerical integration - Trapezoidal rule - Simpsons 1/3 and 3/8 rules.

UNIT-III

Numerical solution of algebraic and transcendental equations - Bolzono's bisection method - successive approximation method - Regula-Falsi method - Newton-Raphson method, Graffe's Root Squaring method.

Numerical Solution of simultaneous linear algebraic equations - Gauss elimination method - Gauss Jordan elimination method - Gauss-Seidel iteration method - Crout's method.

UNIT-IV

Numerical Solutions of ordinary differential equations of first and second order simultaneous equations - Taylor series method - Euler's method - improved Euler's method - modified Euler's method - Runge-Kutta method of second and fourth order Milne's - Predictor corrector method - Picards method.

UNIT-V

Numerical Solution of partial differential equation - Elliptic equation - Poisson's equation - Laplace equation - Lieberman's iterative method - Relaxation method - Hyperbolic equations - One dimensional heat equation - Bender-Schmidt recurrence - relation - Crank - Nicholson's implicit method.

Text Books:

1. Venkatraman M.K., Numerical Methods in Science and Engineering, National Publishing Co., Chennai, 1995.
2. Kandasamy P, Thilagavathy K and Gunavathy K., Numerical Methods, S.Chand & Co., 2nd ed.,2005.

Reference Books:

1. Gereald C.F. and Wheatley P.O., Applied Numerical Analysis, Addison Wesley Pub. Co., 1994.

MEEC502 MECHANICS OF MACHINES – II

OBJECTIVES

To analyze the inertia force and inertia torque in flywheels.
To study the undesirable effects of unbalances resulting from prescribed motions in mechanism.
To visualize the effect of Dynamics of Undesirable Vibrations

UNIT - I

Turning moment and flywheel - inertia force and inertia torque calculations- turning moment in reciprocating engine - coefficient of fluctuation of energy - fluctuation of speed - Flywheels for machines like punch press and I.C.Engines.

UNIT- II

Static and Dynamic balancing - Balancing of rotating masses in different planes.

UNIT- III

Balancing of reciprocating masses - multi-cylinder in-line, V- type, radial and locomotive engines - Primary and Secondary forces - Partial balancing - Tractive efforts, swaying couple and hammer blow in locomotives - Direct and reverse crank method.

UNIT- IV

Vibration: Vibration of single degree freedom systems - free, damped oscillation - Damping factor -Logarithmic decrement Forced vibration- Magnification factor - Vibrating isolation and Transmissibility - Vibration measuring instruments.

UNIT- V

Transverse vibration-natural frequency by energy method- Dunkerly method- Whirling of shaft - critical speed with single and two rotors.

Torsional oscillation of two and three rotor systems - equivalent shaft-Geared systems

Text books:

1. Abdulla Sheriff, Theory of Machines, Dhanpat Rai, New Delhi,.2006.
2. Amitabh Ghosh, Ashok Kumar Malik, Theory of Mechanism and Machines, Affiliated East West Press Ltd.,1998.

Reference Books:

1. Thomas Bevan, Theory of Machines, CBS Pub.,2001
2. P.L.Ballaney, Theory of Machines, Khanna Publications,23rd ed., New Delhi,2003,
3. W.G.Green, Theory of Machines, Blackie Publications
4. J.E.Shigley, Theory of Machines, McGraw Hill,1996

MEEC503 HEAT ENGINEERING - II

OBJECTIVES

To apply the thermodynamic concepts into various thermal application like rotary compressors, steam nozzles, steam turbines and gas turbines.

To study the basics of jet propulsion and rocket propulsion

UNIT -I

Rotary Compressors : Centrifugal compressor - velocity diagrams - performance characteristics - pressure coefficient and slip factor - surging Axial, radial and mixed flow compressors - velocity diagrams - performance characteristics .

UNIT - II

Steam Nozzles - Effect of back pressure - condition for maximum discharge - effect of friction - supersaturated flow - impulse steam turbine - velocity diagrams - blade efficiency - stage efficiency - end thrust - reheat factor.

UNIT - III

Reaction steam turbine - degree of reaction - 50 % reaction turbine - influence of blade speed to steam speed - height of reaction blading - Method of compounding steam turbines - Methods of governing steam turbines.

UNIT - IV

Gas turbine - cycles - optimum pressure ratio for maximum output - component efficiencies - intercooling and reheating regenerations - gas turbine combustion chambers - different types of combustor arrangements.

UNIT - V

Introduction to Jet propulsion systems - Aerofoil theory - Lift and Drag - Ramjet - Turbojet - Rocket propulsion - Thrust - Specific impulse - propulsion efficiency and overall efficiency.

Text Books:

1. Ballaney P.L., Thermal Engineering, 24th edition, Khanna Publishers, New Delhi,2003.

Reference Books:

1. Khurmi R.S., Thermal Engineering, S.Chand & Co., New Delhi.14th ed. 2005.
2. Cohen and Rogers, Gas Turbine Theory and applications,
3. Kearton, Theory of steam turbine, CBS Pub.2001.
4. Mathur M.L. & Mehta F.S., Thermodynamics and Heat Power Engineering, Vol-I and Vol-II, Jain brothers, New Delhi, 2002.

MEEC504 HYDRAULICS AND PNEUMATICS

OBJECTIVES

To study the applications of basics of fluid mechanics on hydraulic machineries like hydraulic turbines, pumps, etc., and to study the pneumatic circuits and systems.

UNIT- I

Fluid power systems- advantages and applications. Pressure of a jet on stationary and moving blades. Hydraulic jet propulsion, classification of hydraulic prime movers. Comparison of Impulse and reaction turbines. Pelton wheel, specific speed- velocity diagram for impulse turbine.

UNIT- II

Reaction turbines - outward, inward and axial. Diffusers - draft tubes - races - Francis and Kaplan turbine – cavitation. Velocity diagrams - specific speed.

UNIT- III

Centrifugal pump - Volute casing - velocity diagram for vane - Manometric and hydraulic efficiencies - pumping speed - cavitation - specific speed.

Reciprocating pumps - Bucket, Plunger and deep well pump - Slip and coefficient of discharge - Pump duty - Pressure variation in single cylinder single acting pump with and without air vessel.

UNIT- IV

Fluid systems and circuits – Introduction to Industrial hydraulics. ram, air lift pump, actuators, pressure switches. Electro hydraulic and mechanical hydraulic servo systems. Compressors, filter, regulator, lubricator, muffler. Air control valves, quick exhaust valves-pneumatic actuators.

UNIT- V

Selection of components for hydraulic and pneumatic system applications. Installation, fault diagnosis, and maintenance. Micro processor and PLC applications, power packs.

Text Books:

1. Bansal R.K., Hydraulic Machines, Lakshmi Pub. Pvt. Ltd., New Delhi, 1997,
2. Majumdar.S.R.Pneumatic systems – Priniciple and maintenance, Tata McGraw Hill,2001.

Reference Books:

1. Khurmi R.S., Hydraulic Machines, S.Chand & Co., New Delhi,2nd ed, 2005.
2. Majumdar.S.R.Oil Hydraulic systems,, Tata McGraw Hill,2001,
3. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co, Pvt,Ltd., New Delhi,1997.

MEEC505 MACHINE DESIGN – II

(Use of approved Design data book is permitted in the Examination)

OBJECTIVES

To gain knowledge on the principles and procedure for the design of power Transmission components.

To understand the standard procedure available for Design of Transmission systems.

To learn to use standard data and catalogues.

UNIT – I

Bearings - Hydrodynamic Journals Bearings - Design procedure - Minimum film thickness - Selection of Artification bearings - Life of bearings - Equivalent load, Cubic mean load - load rating - Design Procedure.

UNIT - II

Belt Drives of flat belts, V-Belts using manufacturer's table - Matched set of V-Belts, Chain drives for Power transmission design procedure.

UNIT - III

Gear drives: Toothed gear - types of failure - Design analysis - Gear Materials - Design of spur and Helical gears based on surface strength and bending strength - Forces acting on toothed gears.

UNIT - IV

Bevel and worm gears, Bevel gears classification - terminology - forces on bevel gear tooth - Design procedure - working gears - Design of worm gears - Terminology - centre distance - losses - design procedure.

UNIT - V

Gear Box: Standard Step ratio - Speed diagram - Kinematics layout - Design of six speed, twelve speed ,eighteen speed gear box - calculation of actual speed.

Text Books:

R.S. Khurmi, Machine Design, S.Chand company ltd., 14th ed. 2005.

Reference Books:

1. Richard Bundyas.Shigley, Mechanical Engineering Design, McGraw Hill Book Company
2. T.J.Prabhu, Design of Transmission Elements, 4th ed. 2000.
3. T.V.Sundarajamoorthy, N.Shanmugham, Machine design, Khanna Publihers

MEEC506 PRODUCTION TECHNOLOGY - II

OBJECTIVES

To understand the concepts of special purpose machines, metal cutting, grinding and metrology.

To understand the basic concepts of jigs and fixtures and unconventional machining

UNIT-I Special Purpose Machines:

Broaching: Types of broaching machines - broach nomenclature.

Gear manufacture: Elementary ideas of gear shaping - gear hopping and gear generation.

Surface finishing processes: Elementary ideas of lapping and honing - surface finish - polishing and buffing.

UNIT - II Metal Cutting:

Types of cutting tools, tool materials - Elementary ideas of machinability - nomenclature of single point tools - Principles of orthogonal machining - types of chips, merchents theory - merchents circle (simple problems) - power requirements for turning - tool wear - use of cutting fluids - tool life equation (simple problems)

UNIT - III Grinding and metrology

Grinding and allied processes - types of grinding machines - grinding wheels specifications abrasive materials. Metrology: Line standards and end standards - comparators for inspection - use of optical flat and autocollimator - measurements of surface finish - gear inspection.

UNIT - IV Jigs and Fixtures:

Basic Concepts - advantages - types of jigs - Elements of jigs and fixtures - Locating devices and types - 3-2-1 principle - clamping devices and types - drill jigs - template jigs - types of fixtures - milling fixtures - turning fixtures.

UNIT - V Unconventional manufacturing Process:

Principle and mechanism of Electro discharge machining, Electro chemical machining, Ultra sonic machining, Laser machining , abrasive jet machining. Automats and transfer machines: Single spindle and multiple spindle automatic lathes, transfer machines - Rotary indexing lathe and drum type transfer machines.

Text Books:

1. Jain R.K. and Gupta S., Production Technology, , New Delhi, Khanna pub., 16th ed,2006.
2. Khanna O.P., & Lal M., Production Technology, Vol II Dhanpath Roy & Sons, 2000.

Reference Books:

1. Chapman W.A.J., Workshop Technology Vol.I,II & III, CBS pub, 2001.
2. Hand book of Industrial Metrology - ASTME
3. Bhattacharya A., New Technolgy, The Instituition of Engineers (India)
4. Haskehurot M., Manufacturing Technology, The English University Press Ltd. London.

MEEC507 INDUSTRIAL ENGINEERING AND MANAGEMENT

OBJECTIVES

Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students are exposed to organizations behaviour and production management. Students will also gain some basic knowledge on international aspects of management.

UNIT-I: Management

Functions of management, scientific management - Contributions of F.W.Taylor, Frank & Lillian Gilbreth, H.Gantt, Henry Foyal's principles of management.

Management by objectives (MBO), Management by exception (MBE) - Strategies & policies - Decision making & group decision making - Line & staff functions - Organizational development.

Comparative and International management - Management information systems (MIS) - Information systems in decision making - systems modeling for MIS - Data base management systems.

UNIT-II: Engineering Economics

Nature and scope of managerial economics - Basic economic tools in Managerial economics - Introduction to macro & micro economics.

Law of Demand and supply, elasticity - determinants and uses.

Cost and Revenue: Average, Total, Marginal and fixed cost concepts - Average, Marginal and Total Revenue concepts - their significance.

Market conditions: Perfect, Monopoly, Monopolistic & Oligopoly - Porter's five forces model of competition.

Capital Budgeting: Pay back period, NPV, BCR and IRR.

Free Trade Vs Protection - Globalisation and India.

Depreciation methods - uses - Simple problems.

UNIT-III: Organisational Behaviour

Introduction to Organisational Behaviour - Motivation & work performance - Content and cognitive theories - stress management - Inter group dynamics & management of groups.

Leadership theories - conflict management - Organisation development - managing organisational change process.

Job evaluation - methods - Job design and redesign - simple problems - Merit rating.

UNIT-IV: Production Management

Plant location - objectives and models - Break-even model, Factor comparison model, Brown Gibson model - Illustrative problems.

Plant layout - Objectives - types - process, product, fixed position and group.

Process layout - travel chart, load distance analysis, CRAFT - Simple problems.

Product layout - Line balancing - Largest candidate rule - Ranked positional weights method - COMSOAL - Simple problems - Material handling - principles - Introduction to Group technology and FMS.

UNIT-V: Work Study

Work simplification - basic procedure - process charts - SIMO, diagrams, memomotion & cyclographs.

Motion study - therbligs - principles of motion economy.

Work measurement - basic procedure - stop watch method (rating method) work sampling, PMTS, estimating-analytical & comparative.

Reference Books:

Unit-I

1. Harold Koontz & Heinz Wrihrich, Management, McGraw Hill.
2. Robert G Murdick, Ross J.E. and Claggett J.R., Information system for modern management, Prentice Hall.

Unit-II

1. Maheshwari K.L., et all, Managerial Economics, Sultan Chand & Sons, New Delhi.
2. Heilbroner R.L. and Thurow L.C., Understanding Microeconomics, Prentice Hall.
3. Jain S.K., Applied Economics for Managers and Engineers, Vikas Publishers, 1997.

Unit-III

1. Uma Sekaran, Organisational Behaviour, Tata McGraw Hill.
2. Tripathi, Personnel Management, Sultan Chand & Sons, New Delhi.

Unit-IV & V

1. Chary S.N., Production & Operations Management, Tata McGraw Hill, New Delhi.
2. Martand Telsang, Industrial Engineering & Production Management, Sultan Chand & Sons, New Delhi.
3. Elwood S Buffa, Operations Management, Wiley Publishers.

MEEP508 CIVIL ENGINEERING LABORATORY

(A) STRENGTH OF MATERIALS LABORATORY

OBJECTIVES

To impart practical training on simple machines like screw jack, worm wheel, etc.,

To understand the theoretical and practical aspects of elasticity and plasticity of the materials through a variety of experiments

- - -

Simple Machines:

Mechanical advantage and efficiency of screw jack, worm wheel, differential wheel and axle.

Material Testing:

Tension, compression and shear tests on different materials deflection tests on beams - Hardness, impact and ductility tests (on metals, torsion tests on rods and spring-fatigue tests, demonstration only).

- - -

(B) HYDRAULICS LABORATORY

OBJECTIVES

This course includes the experiments on study and performance tests on centrifugal pumps and reciprocating pumps, Pelton and Francis turbines. The learner is also made to understand the principles of venturimeter and orificemeter with the help of simple experiments.

- - -

Determination of co-efficient of discharge, velocity and contraction for the different types of orifices and mouth pieces.

Determination of the co-efficient of discharge, equations for triangular and rectangular notches, venturimeter.

Determination of the friction factor of the pipes - determination of losses in pipe lines due to change in section and direction.

Determination of the co-efficient of orificemeter and discharge equation.

Determination of the co-efficient for different types of vanes. Determination of the metacentric height of the model of a ship.

Characteristic curves for different types of centrifugal and reciprocating pumps. Pelton and Francis turbines.

- - -

MEEC601 POWER PLANT ENGINEERING

OBJECTIVES

To understand the various components, operations and applications of different types of power plants

To study the economics and safety aspects of power plants

UNIT- I

Introduction to types, layouts and working cycles:

Layouts of diesel-electric, hydro-electric, nuclear, gas turbine, steam, cogeneration, MHD, and other power plants – Site selection – Reheat and Regenerative steam cycles – Binary vapour cycle – combined cycle – Topping cycle – Power plant instrumentation and control- air flow, furnace pressure, steam temperature control system- governing system- Steam turbine

UNIT – II

Fuels, combustion and burning methods:

Fuel classification – Solid, liquid and gaseous – Compositions and heating values – Classification of coal – combustion process, atmosphere and control -ESP

Furnace construction - stokers – suspension firing – pulverised fuel firing – oil and gas burners and systems – Fuel control - Burner management system - FSSS– Ash handling system.

UNIT- III

Steam power plant:

Steam generators - fire tube, water tube, forced circulation, once through, super charged, super critical, Lamont, Loeffler, Schmide, Hortmen and Velox boilers, Fluidised Bed & Circulated Fluidised Bed boilers - Natural, artificial, balanced and steam jet drafts - Simple problems – Functions of super heaters, economisers, air-heaters, deaerators, feed heaters, air ejectors- Feed pumps - Injectors – Feed water control- Condensers - Jet, surface - Simple problems - cooling towers.

UNIT- IV

Nuclear power plant:

Basics of Nuclear fuels-Fission and chain reaction - – Reactor classification - Boiling water, pressurised water, homogeneous, gas cooled breeding and metal cooled.

UNIT - V

Economics and safety:

Actual load curves - fixed and operating costs - Tariff methods for electrical energy - peak load and variable load operations - selection of generation type and general equipment. Introduction to safety aspects in power plants- Environmental impacts assessment for Thermal power plant

Text Books:

1. Arora C.P. and Domkundwar, A course in Power Plant Engineering,Dhanpat Rai Pub .
2. P.K.Nag, Power Plant Engineering, Tata McGraw Hill, New Delhi
3. G.R. Nagpal, Power plant Engineering, Khanna Pub.2004.

Reference Books:

1. Moarse, Power plant Engineering,
2. M.M.El-Wakil, Power plant Technology, Tata McGraw Hill, New Delhi,
3. Vopat and Skrotzki, Power Plant Engineering, Tata McGraw Hill, New Delhi
4. Geldart, Fluidised Bed Technology
5. Howard, Fluidised Bed Technology.

MEEC 602 ENGINEERING METALLURGY

OBJECTIVES

To Impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I

Unit cell ,Crystal system , BCC,FCC & structures ,Crystallographic planes &direction, Miller indices, Crystal imperfections – point, line & area defects .Grain size ASTM grain size number ,grain size measurement. Constitution of alloys, compounds & solid solutions, Gibbs phase rule, lever rule, isomorphous, eutectic, eutectoid and paratactic systems. Metallography – metallurgical microscope- preparation of specimen, micro & macro examination.

UNIT II

Iron – Carbon equilibrium diagram , plain carbon steels – effect of C, Mn, Si, P & S. Purpose of alloying, effect of important alloying elements – Important low alloy steels, stainless steel, tool steels – types, compositions and applications; cast iron – types, composition and applications.

UNIT III

Heat treatment of steel : Isothermal transformation diagram – Continuous cooling transformation diagrams , full annealing , stress relief annealing, spheroidising, normalizing, Hardenability and Jominy end quench test –Austempering and martempering – case hardening , carburising , intruding , cyaniding and carbon intruding ,flame hardening , induction hardening, vacuum hardening and cryogenic treatment.

UNIT IV

Non ferrous metals: Aluminum alloys, Copper alloys , Nickel alloys, Titanium alloys – properties and application.

Powder metallurgy : Process fundamentals, production of metal powders, characteristics , powder blending , compacting, sintering , applications.

Corrosion – Factors influencing corrosion , inter – granular corrosion- corrosion prevention.

UNIT V

Mechanical behaviour of materials : tensile behaviour : engineering stress , engineering strain, true stress , true strain , Stress – strain curve, Yield point phenomenon , strain aging impact behaviour Charpy and Izod impact testing ,DBT curve. Hardness: Brinell hardness , Rockwell hardness , micro hardness testing ; Fatigue behaviour: Stress cycles S –N curves , fatigue crack initiation , fatigue crack propagation ;Creep behaviour : curve, creep mechanisms, deformation mechanism maps ; Simple problems.

Text Books:

1. Introduction to physical Metallurgy ,Sydney H.Avner S.H, Mc Graw -Hill Book co ., 1998.
2. Engineering Metallurgy – Part I, Applied Physical Metallurgy , Higgins R.A.,ELBS 1983.

Reference Books:

1. Rollason , E.C ., Metallurgy for Engineers, ELBS.
2. Nayak S.P, Engineering Metallurgy, Charotar Book stall, Anand.
3. Sinha A.K., Powder Metallurgy, Dhanpat Rai & Son , New Delhi, 1995.
4. Raj Narayan, An Introduction to Metallic Corrosion & its prevention, Oxford & IBH, New Delhi,1983.

MEEC603 AUTOMOTIVE ENGINEERING

OBJECTIVE

To impart knowledge to students in transmission, steering, suspension systems, rear axles and final drive of Automobiles

To study the concepts of electrical system of automobiles, use of alternative fuels, automobile pollution and control.

UNIT -I

The Clutch - Function- Single plate, multi plate clutches - Torque converters - Gear Boxes - Function – Sliding mesh - Constant mesh and synchromesh gear boxes - Selector Mechanism - Automatic operation of gear boxes - over drive - Front wheel drive - Propeller shaft and universal joints - Constant velocity Universal joints.

UNIT - II

Front axle and steering geometry - Principle of power steering - steering mechanism - Recirculating ball mechanism - cam & double pin steering gear boxes - Camber angle, Caster angle, King pin inclination - Types of frames and suspension systems. Independent suspension - Rear suspension - Pneumatic suspension.

UNIT - III

Rear axle - final drive - Single and double reduction axle, torque and thrust members - arrangements. Differential - function of differential - differential lock - rear axle-housing construction - Rear axle arrangements.

Brakes - Mechanical, disc, hydraulic and pneumatic brakes - servo brakes.

UNIT - IV

Electrical system of the automobile storage battery - starters - generators - regulators and alternators - Ignition system - coil ignition system, and transistor ignition system - Gasoline injection. Alternate fuels-LPG, CNG, Methanol, Ethanol.

UNIT - V

Sources of automotive pollution - Petrol engine pollution and Diesel engine pollution - formation of oxides of nitrogen, carbon monoxide, hydrocarbon, and smoke, particulate emission - evaporative emission control, crankcase emission, Air fuel mixture, EGR, air injection, thermal reactors in cylinder control of pollution, catalystic converters. Use of driving cycles for emission measurements. National and International standards. Non dispersive infrared gas analyser, Smoke measurements and smoke meters.

Text Books:

1. R.B.Gupta, Automobile Engineering, Sathya Prakasam New Market, New Rohta road, New Delhi.
2. M.K.Mangal, Diesel Mechanics, Tata McGraw Hill
3. Crouse William, Automotive Emission control, Gregg Division McGraw-Hill,

Reference Books:

1. John.B.Heywood, Internal Combustion Engines, McGraw-Hill
2. Newton & Steeds, Motor Vehicles,
3. V.M.Hillier, Fundamentals of Motor Vehicle technology,
4. Heitner, Automobile Engines.

MEEC604 OPERATIONS RESEARCH

OBJECTIVES

To provide an understanding of the systematic approach to solve decision making problems and to enhance the decision making skills through the application of appropriate models.

UNIT - I

Linear programming - graphical method - simplex method - Duality, Dual simplex method - Applications.

UNIT - II

Transportation problems - optimal solutions. Assignment problems - Hungarian algorithm - Traveling salesman problem - Applications.

UNIT - III

Waiting line problems - cost of waiting and cost of providing service - single channel - single stage type of problems - Monte Carlo simulation for queue problems Competitive strategy - Games theory - two persons zero sum game problem with and without saddle point - method of oddments - graphical method - method of determinants - concept of dominance - Algebraic method - iterative approximate method.

UNIT - IV

Network models - Minimal spanning tree problem, shortest route problem. PERT and CPM - basic steps -rules for constructing the network - Fulkersons rule - time estimates - PERT calculations - probability of meeting the time schedule- time cost trade off- difference between PERT and CPM - applications - Introduction to resource leveling.

UNIT - V

Decision Theory - Decision making under risk condition - expected value criteria - Decision trees - Decision making under uncertain condition - Minimax, maximin, maximax, laplace, hurwics, regret criteria.

Text Books:

1. Taha., Operation Research, Tata McGraw- Hill, 1998
2. Vohra N.D., Quantitative techniques in management, TMH, 1990.

Reference Books:

1. Sharma S.D., Operations Research, Kedar nath ram nath and co., Meerut, 1998
2. Dharani Venkatakrishnan, Operations Research,Kerthi Pub. House, Coimbatore, 1990
3. Ravindran A., Phillips D.T., and Solberg J.J., Operations Research, Principles and Practice, John Wiley and Sons, Singapore, 1987.
4. Gupta & Hira, Operation Research, S.Chand & Co.,3rd ed. 2005.
5. Bronson R., Theory and problems of Operations Research, Schaum's outline series, 1997.
6. Eppen and Gould, Quantative concepts for management, Prentice-Hall, 1979.

MEEC605 REFRIGERATION AND AIRCONDITIONING

OBJECTIVES

To provide in-depth study of the basics of refrigeration and air-conditioning

To study the various refrigeration systems and their thermodynamic cycles.

To study the basics of psychrometry and cooling load calculations of air-conditioning systems.

UNIT- I

Introduction - Unit of refrigeration - Refrigeration systems - Refrigeration cycles and concepts - Coefficient of Performance - Reversed Carnot cycle - Refrigeration system as heat pump - Air Refrigeration - types - problems.

UNIT- II

Introduction to Steam Jet Refrigeration, vapour absorption refrigeration and Solar refrigeration - Theory only - Performance Analysis of vapour Compression cycle - Ideal and actual conditions - Problems - Representation of cycle on p-h and T-s diagrams - Properties of refrigerants and their choice for different applications – Eco friendly refrigerant.

UNIT- III

Refrigeration equipment - Description only with sketches - Compressors - Reciprocating, centrifugal and screw - open, hermetic and semi-hermetic units - condensers - air and water cooled condensers, evaporative condensers - Evaporators - Double tube, Shell and Tube, Dry and flooded types - Expansion devices - Protection devices - High and Low pressure cut out Thermostat - solenoid valve.

UNIT- IV

Psychrometry of Airconditioning Processes - Adiabatic mixing, sensible cooling and heating, latent heat process, total heat process, sensible heat factor - By-pass factor - Cooling and Dehumidifying coil, heat coils, air washer, adiabatic dehumidifiers, water and steam injection - Problems on psychrometric processes.

UNIT- V

Airconditioning system - classification - Unitary, packaged and central type summer and winter air-conditioning systems - Description with sketches - merits and demerits - Comfort indices - Air purification - Airconditioning - Heat gain and load calculations - RSHF, GSHF and ESHF - Need for reheating.

Text Books:

1. Arora S.C. & Domkundwar S., Refrigeration and Air-conditioning, Dhanpat Rai & Sons, New Delhi, 1995.
2. Ballaney P.L., Refrigeration and Air-conditioning, Khanna Publisher, New Delhi 13th ed, , 2003
3. R.S Khurmi& J.K.Guptha, Refrigeration and Air-conditioning, S.Chand & company ltd New Delhi 3rd ed.2005.

Reference Books:

1. Harris, Modern Air-conditioning, McGraw-Hill Book Co, New Delhi
2. Roy J. Dossat, Principles of Refrigeration, Pearson education, Asia,2001.
3. V.K Jain, Refrigeration and Air-conditioning, S.Chand & company ltd , New Delhi

MEEC606 TURBOMACHINERY

OBJECTIVES

To provide in-depth knowledge of dimensional analysis of turbo machines.
To enlighten the thermodynamic aspects of energy transfer.
To study the flow characteristics of turbo machines.

UNIT – I

Introduction to turbo machinery of all types-applications-Comparison between positive displacement machines with turbo macine-Definition,classification,governing equations-Euler's equations-Forces on rotor blade-Components of energy transfer-Work and efficiencies in Turbine stage(Total-to-total, Total-to-static, Polytrophic and finite stage)-Effect of reheat factor in turbine-Work and efficiencies in compressors stage(Total-to-total, Static-to-static, Polytrophic and finite stage)-Effect of preheat factor in compressor-With simple problems in turbine and compressor.

UNIT – II

Aerofoil section-Classification-lift and drag on the blade-Blade terminology-Flow through cascade, One and Two-Dimensional flow through a cascade-Cascade testing-Measurement of static pressure distribution-Cascade variables-Axial turbine cascade, Nomenclature, Velocity triangles and Blade forces.
(Zweifel's Criterion)-Losses-Estimation of losses using empirical correlations (Hawthrone's,Ainley's and Soderberg's)
Axial compressor cascade,nomenclature,velocity triangles,blade forces,Static pressure rise and cascade efficiency-Losses-Estimation of losses using empirical correlations (Howell's)-Annular cascades-Radial cascade.

UNIT – III

Axial flow fans and propeller-Components-Description-Types of axial fan stages-Fan stage parameters-Stage work, Stage pressure rise, Stage pressure coefficient, reaction ratio and fan efficiency-Propeller-Slip stream theory-Blade element theory-Performance of axial fans, Centrifugal fans and Blowers-Components-Description-Types of centrifugal fan-Backward-Swept, Radial and Forward swept blade-Velocity triangles-Stage parameter-Stage work-Stage pressure rise-Pressure coefficient-Stage reaction-stage efficiency-Design parameter-impeller size-blade shape-number of blades. Drum type, Partial flow,Losses,fan bearings, fan drives, fan noise and dust erosion of fan.

UNIT – IV

Radial turbine stages-Elements of radial turbine stage-IFR turbine with cantilever blade-Ninety degree IFR turbine-inward mix-flow turbine-velocity triangles - h-s diagram-Spouting velocity-stage efficiency-Effect of exhaust diffuser-Degree of reaction-Stage losses-Performance characteristics-blade to gas speed ratio-Out ward flow radial turbine (Ljungstrom turbine) theory only.

UNIT – V

Dimensional Analysis and Similarity law-Applied to Incompressible flow machine-head,capacity,power coefficient-Reynolds number and Mach number-Specific speed-Compressible flow machine-Pressure ratio-Dimensionless speed and mass-flow parameter-power coefficient-Reynolds number-Performance characteristic curves of turbine,compressor,fan,blowers and cascade(with some dimensionless parameter).

Text Book

1. Yahya.S.M, Turbines, Compressors and fans, Second ed.2002, Tata McGraw Hill.

Reference Books

1. Shepered D.G., Principles of Turbo machines, Macmillan Company.
2. William J Kearton, Steam Turbine theory and Practice, CBS Pub.2001.
3. Stodala, Steam and Gas Turbine.
4. Vincent, Theory and Design of gas turbine and jet engine.
5. Lee Vincenty, Theory and Design of steam and gas turbines.
6. Dixon S L, Fluid Mechanics: Thermodynamics of Turbo machinery, 4^{th} ed., Butterworth-Heinemann, 1998.

MEEP607 WORKSHOP PRACTICE - III

OBJECTIVES

To provide a hands-on experience in handling precision metrology instruments, their calibration to have practical exposure in conducting and analyzing metal cutting experiment.

- - -

The Syllabi for the above laboratory will be suitably and appropriately framed by the Head of the department from time to time depending on textual background, availability of machines and any future infrastructural development.

.

- - -

MEEP608 MECHANICAL ENGINEERING LABORATORY - II

OBJECTIVES

Students are trained to conduct performance tests on I.C. engines and steam boilers, steam turbines, steam engines and steam condensers

Practical training on conducting experiments on governors, flywheel, cam and follower, balancing and vibration is given to the students

-- -

Experiments in I.C.Engines, Steam and Dynamics Laboratories.

The Syllabi for the above laboratory will be suitably and appropriately framed by the Head of the department from time to time depending on textual background, availability of machines and any future infrastructural development.

- - -

MEEC701 HEAT AND MASS TRANSFER

(Use of approved Heat and mass transfer data book is permitted)

OBJECTIVES

Modes of heat transfer and physical significance non-dimensional numbers and empirical correlations in the analysis and applications of heat and mass transport processes.

UNIT –I Conduction

General introduction – modes and basic laws of heat transfer- general heat conduction equation (Cartesian) –one-D cylinder and spherical co-ordinates. Electrical analogy to heat flow-concept of thermal resistance. One-D steady state heat conduction (simple geometries; composite walls, concentric cylinder and sphere -problems).

Logarithmic mean area of cylinder- critical thickness of insulations- temperature effect on thermal conductivity- extended surfaces - governing partial differential equation – one-D fin of uniform cross-section -simple problems. Introduction to unsteady heat transfer- lumped mass analysis (one mass only)- use of Heisler's chart

UNIT –II (Convection)

Introduction to free and forced convection- elementary concept of boundary layers (hydro dynamic and thermal) without problems- critical Reynolds number.

Fully developed flow inside tube (simple problems)- dimensional analysis applied to forced and free convection – selected dimensionless groups– empirical relations.
Heat transfer with phase change (boiling and condensation).

UNIT –III (Radiation)

Introduction- absorption, reflection and transmission of radiation– Kirchoff's Law– Planck's law– Wein's displacement law– Lamberts cosine law – radiation intensity- total emissive power – spectral emissive power – black and grey body concept – radiosity. Geometrical shape/view factors – reciprocity theorem/relations – radiation heat exchange between (i) two infinite parallel planes (ii) two bodies- small body is completely enclosed by the other (iii) equal parallel and opposite black squares, disc or rectangles – radiation shields – reradiating surfaces.

UNIT –IV (Numerical heat transfer)

Conversion of partial differential equation (steady and unsteady) into finite difference equation-numerical method of solution, for simple one/two dimensional system (relaxation or Gaussian elimination or iteration method- simple problems)– separation of variables- Numerical solution to unsteady state heat transfer with simple problem.

UNIT –V (Applications)

Heat exchanger – basic types and classification – construction of heat exchangers– LMTD – effectiveness - NTU method – fouling factor -overall heat transfer coefficient – combined heat transfer by conduction, convection and radiation – automobile and electronic component cooling.
Mass transfer concept and Fick's first law of diffusion - analogy between heat and mass transport. Diffusion mechanism of air-water (two component system).

Text book:

1. Holman J. P, Heat transfer Mc Graw Hill Co. 2007
2. Ozisik M. N., Basic heat transfer Mc Graw Hill Co. 1985

Reference :

1. Dr.Kamaraj.G and Raveendian.P, Heat and Mass transfer, Scitech pub.2008
2. Domkundwar and arora A A course in Heat and Mass Transfer, Danpati rai & sons New Delhi,2004.
3. Frank Kreith Principles of Heat transfer Harper & Row New Yark 1986.
4. Rajput R K Heat and Mass transfer S Chand & company, 3rd ed.2006.
5. Nag. P.K, Heat transfer TMH pub. 2005
6. Kothandaraman C P. Fundamentals of Heat and mass transfer, New Age International,2nd ed.2004

MEEC702 FINITE ELEMENT ANALYSIS

OBJECTIVES

To understand the principles involved in discretization and finite element approach
To learn to form stiffness matrices and force vectors for simple elements

UNIT-I

Fundamentals of stress-strain relationships, strain - displacement relationships, boundary conditions, temperature effects, Saint Venant's principle, Introduction to variational formulation and Galerkin's method.

UNIT-II

Properties of Matrices and determinants, Gaussian elimination, Cholesky factorisation, conjugate gradient method.

UNIT-III

One dimensional problems, Finite element modelling, Coordinates and shape functions - The potential energy approach - assembly of global stiffness matrix and load vector - treatment of Boundary conditions - Quadratic shape functions.

UNIT-IV

Constant strain triangular element - axisymmetric solids subjected to axisymmetric loads - two dimensional isoparametric elements - numerical integration.

UNIT-V

Introduction to field problems - Simple Finite element applications using the elements discussed in the earlier units.

Text Book:

1. Tirupathi R. Chandrupatla & Ashok D. Belegundu, Introduction to Finite Element in Engineering, 3rd ed.2004, Prentice Hall of India, New Delhi.

Reference Books:

1. Ramamurti V., Computer Aided Mechanical Design and Analysis, Tata McGraw Hill, New Delhi.
2. Cook R.D., Concepts & Applications of Finite Element Analysis, second edition, 1981, John Wiley.
3. Krishnamoorthy C.S., Finite Element Analysis:Theory and Programming, 1987, Tata McGraw Hill, New Delhi.
4. Zienkiewicz O.C., The Finite Element Method, third edition, 1997, McGraw Hill, New York.
5. Timoshenko S.P and Goodier J.N., Theory of Elasticity, third edition, 1970, McGraw Hill.

MEEC703 RENEWABLE ENERGY SOURCES

OBJECTIVES

This course will enable the student,

To gain knowledge on the various renewable energy sources like solar, wind, tidal, geothermal, biogas, biomass, OTEC and tidal.

To understand the construction and working of various solar energy gadgets.

UNIT – I

Alternative energy sources. Global and Indian energy scenario. Solar Energy: Introduction - Solar Radiation Measurement and Instruments - Data and estimation.

UNIT – II

Flat plate collectors - General description, characteristics of flat plate collector - overall heat transfer coefficient - collector heat transfer coefficient - collector heat removal factor and flow factor performance - Solar selective surface.

UNIT – III

Focusing solar collectors. Types - General characteristics - material and construction - performance - Solar furnace.

UNIT – IV

Solar air heater: Different types - performance and application - simple problems.

Solar water heater: types, characteristics and performance simple problems.

Solar cookers - Fundamentals of Solar stills - Solar ponds and Solar pumps - Solar cabinet dryers - Forced convection solar dryers - Principles of Solar cells.

Solar space heating and cooling system - Elementary design methods. Storage of solar energy.

UNIT – V

Wind energy utilisation : Introduction - Types of wind mills - elementary design.

Elementary ideas of tidal and ocean thermal energy and geo thermal energy: Biomass as a source of energy - production of fuel from agricultural waste - Biogas - generation and utilisation.,

Text Books:

1. Rai G.D., Solar Energy utilisation - Khanna Publishers, New Delhi, 5th ed.,2004.

2. Garg. H.P., Solar Energy fundamentals and applications, Tata McGraw-hill, New delhi,2008.
3. Sukhathme. S.P. – Solar Energy, 3rd ed.,Tata McGraw-Hill, New Delhi,2008.

Reference Books:

1. Duffie J.A & Beckman W.A., Solar Energy Thermal Processes, Wiley Interscience.
2. Sayigh A.A.M., Solar Energy Engineering, Academic Press.
3. Kreittor F & Krider J.E., Principles of Solar Engineering, McGraw Hill and Co.
4. Kama Rao, Unconventional Energy Sources, Indian National Scientific Documentation Centre.
5. Tewari S.L & Srinath L.S., A system approach toward Utilisation of wind Energy, NAL, Bangalore.
6. Veziroglu T.N., Alternative Energy Sources -Vol.5 & Vol.6., Hemisphere Pub.1978.

MEEP706 MECHANICAL ENGINEERING LABORATORY – III

OBJECTIVES

To impart training to the students to conduct experiments on heat transfer equipments in which the different modes of heat transfer occurs

To give training to conduct performance tests on heat exchangers and different solar gadgets

To give hands-on training to conduct performance tests on refrigeration and Air-conditioning Plant.

- - -

Experiments in heat transfer - Conduction, Convection and Radiation - Temperature distribution in heat exchangers - use of analogues for Heat Transfer studies - Experiments in Solar Energy.

Study and performance test on Refrigeration and Air-conditioning Plant.

- - -

MEEC801 CAD / CAM / CIM

OBJECTIVES

This course will enable the student

To gain knowledge on how computers are integrated at various levels of planning and manufacturing.

To understand the flexible manufacturing system and to handle the product data and various software used for manufacturing

To understand the basics of robotics.

UNIT - I

Fundamental of CAD - Design Process - Application of Computers for Design.

Hardware in CAD Design workstation - Graphic Terminal - Operator Input /output devices.

Computer Graphics Software and Database - The Software configuration of a Graphics System - Display Generation Co-ordinate System - Resolution - Point Manipulation - Line Generation - Transformations - Translation, Rotation, Scaling, Concatenation. Wire frame modeling and solid Modelling.

UNIT - II

Numerical Control - Introduction - Basic Components of NC system - NC control system - NC part programming - Basic of NC dimensioning - Quadrant Notation - Incremental Dimensioning - Absolute dimensioning - Computer Numerical Control - Direct Numerical Control - Trends and New Developments in NC.

UNIT - III

Introduction to computer graphics - Graphical Input Techniques - Introduction - Pointing, positioning, Rubber banding, dragging, positioning of text, graphics menu and menu alternatives. Fundamentals of 2-D drafting. Introduction configuration of drafting package, Fixing size of drawing, layering. Line types layering, Line types, Text fonts and shapes, entities, blocks, edit commands, displays commands, dimensioning, cross hatching, pattern filling and plotting a drawing.

UNIT - IV

Flexible Manufacturing system: Group Technology - part families, part classification and coding - production flow analysis - machine cells design automation - computer aided process planning - IMS components - application. Automated production.

UNIT - V

Industrial Robots - Basic components in Robotics - Cartesian Co-ordinate Robots - cylindrical co-ordinate Robots - Spherical Co-ordinate Robots - Articulated Robots - Programming - Intelligent Robots - Economics and Robot - Application.

Text Books:

1. Groover M.P. and Zimmers E.W., CAD/CAM - Computer Aided Design and Manufacturing, Prentice Hall of India Pvt. Ltd, 2004.
2. Yoran Korean, Computer Control of Manufacturing System - McGraw Hill International Book Co. 1983.

Reference Books:-

1. Burbridge..J.L, introduction to Group Technology - Heineman London

MEEC802 MECHATRONICS

OBJECTIVES

To understand the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.

UNIT – I

Introduction to Mechatronics- Open and Closed loop system, Mathematical System Models - Mechanical, Electrical, Thermal, Fluid Systems. Node and Loop equations - Laws for governing the Node & Loop equation and Electrical equivalent for Mechanical Systems.

UNIT – II

Transfer function - Procedure for derivation of transfer function of Electrical, Mechanical, Thermal and Fluid System, Block diagram algebra, Signal Flow Graph. Stability conditions – Routh criterion, Frequency response – Polar plot, Bode plot, Nichols plot.

UNIT – III

Sensors - Classifications and Characteristics, Types – Inductive, capacitive, Force, stress, Ultrasonic, Thermal,. Pressure, Film, MEMS , Nano Sensors and Switches.

Signal conditioning – Operational Amplifiers, protection, filtering, ADC and DAC.

UNIT – IV

Actuation Systems –Construction and Working Principle of Stepper motor , Servo motor, Hydraulic and Pneumatic systems

Advanced digital control systems –Study of Architecture and applications of Microprocessor and Micro controller

UNIT – V

Study of Architecture , programming and applications of PLC. Introduction to Mechatronics system design - procedure and case studies

Text books:

1. Bolton -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering, Addison Wesley Longman Ltd., 2003.
2. Nagoor kani.A – Control Systems, RBA publications, Chennai, 2000.
3. Patranabis. D, “Sensors and Transducers”, 2nd edition, PHI, New Delhi, 2004.
4. B.P. Singh, Microprocessors and Microcontrollers, Galcotia Publications (P) Ltd, First edition, New Delhi, 1997.
5. Anthony Esposito, “Fluid Power with Applications”, Pearson Education Inc.,2003
6. Majumdar S.R., “Pneumatic systems – Principles and maintenance”, Tata McGraw- Hill, 2001.
7. Devdas Shetty, Richard A. Kolk, “Mechatronics System Design”, Thomson Learning Publishing Company, Vikas publishing house, 2001.

MEEC803 ETHICS IN ENGINEERING

OBJECTIVES

To create an awareness on Engineering Ethics and Human Values.
To instill Moral, Social Values and Loyalty
To appreciate the rights of others

UNIT – I

Introduction to Engineering Ethics - Senses of "Engineering Ethics" – Variety of Moral Issues – Three Types of Inquiry – Engineering Ethics and Philosophy.

Need for Engineering Ethics- Moral Dilemmas – Moral Autonomy – Kohlber's Theory – Gilligan's Theory – Consensus and Controversy.

Professions and Professionalism - Professions – Membership Criteria – Persuasive Definitions – Multiple Motives.

Model Reasoning and Ethical Theories - Theories about Virtues – Professional Responsibility – Integrity – Self-Respect – Senses of "responsibility"

Theories about Right Action -Utilitarianism – Duty Ethics – Rights Ethics – Testing Ethical Theories -

Self-Interest, Customs, and Religion- Self-Interest and Ethical Egosim – customs and Ethical Relativism – Religion and Divine Command Ethics.

Uses of Ethical theories – Resolving Moral Dilemmas – Justifying Moral Obligations – Relating Professional and Ordinary Morality.

UNIT – II

Engineering as Social Experimentation – Engineering As Experimentation – Similarities to Standard Experiments – Learning from the past – Contracts with Standard Experiments – Knowledge Gained.

Engineering as Responsible Experimenters – Conscientiousness – Relevant Information – Moral Autonomy – Accountability.

The Challenger Case – Safety issues.

Codes of Ethics – Roles of Codes – Codes and the Experimental Nature of Engineering – Limitations on codes.

A balanced outlook on law – A regulated Society – The trend toward Greater Detail – Industrial Standards – Problems with the Law in Engineering – The Proper Role of Law in Engineering.

Safety and Risk – The concept of Safety – Risks – Acceptability of Risk – Lessons for the Engineer.

Assessment of Safety and Risk – Knowledge of Risk – Uncertainties in Design – Testing for Safety – When Testing is inappropriate.

Risk – Benefit analyses and reducing risk – Personal risk – Public risk and public acceptance – accounting publicly for benefits and risks – incentives to reduce risk – some examples of improved safety – liability.

Three Mile island Chernobyl and safe exits – Three Mile Island - Prior warnings – Chernobyl - Three Mile Island, Chernobyl, and a Forerunner - Safe Exit.

UNIT - III

Responsibilities to Employers – Collegiality and Loyalty – Collegiality – Two Senses of Loyalty – Obligations of Loyalty – Misguided Loyalty – Professionalism and Loyalty.

Respect for Authority – Institutional Authority – Morally Justified Authority – Accepting Authority – Paramount Obligations.

Collective Bargaining – Historical Note – Faithful Agent Argument – Public Service Argument – Conclusion.

Confidentiality – Definition – Justification and Limits – Changing Jobs – Management Policies.

Conflicts of Interest – Impairment of Judgment and Service – Gifts and Bribes – Interests in Other Companies – Insider Information – Moral Status.

Occupational Crime – Industrial Espionage – Price Fixing – Endangering Lives.

UNIT – IV

Issues – Professional Rights – Basic Right of Professional Conscience – Institutional Recognition of Rights – Specific Rights: Recognition and Conscientious Refusal – Foundation of Professional Rights.

Whistle-Blowing – Definition – Three Cases – Moral Guidelines – Protecting Whistle-Blowers – Commonsense Procedures – The right to Whistle-Blow – Beyond Whistle-Blowing.

The Bart Case – Background – Responsibility and Experimentation – Controversy – Aftermath – Comments.

Employee Rights – Employee Bill of Rights – Choice of Outside Activities – privacy – Drug Testing – Due process.

Discrimination – Examples – Definitions – Antidiscrimination Laws – Moral Justification of Nondiscrimination Laws – preferential Treatment – Sexual Harassment.

Multinational Corporations – Three Senses of " Relative" Values – "When in Rome" – International Rights – Promoting Morally Just Measures – Technology Transfer and Appropriate Technology – Bhopal.

Environmental Ethics – Case Studies – The Commons and a Livable Environment – Guilty until Proven Innocent? – Internalizing Costs of Environmental Degradation – Technology Assessment – Philosophical View of Nature.

Computer Ethics – Power Relationships – Property – privacy – Professional Issues.

Weapons Development – The Weapons Seesaw – The Engineer's Involvement in Weapons Work – Defense Industry Problems – Decommissioning Weapons and Lasting Effects .

UNIT – V

Engineers as Managers, Consultants and Leaders - Engineers as Managers – Managers as Professional - Promoting and Ethical Climate – Managing Conflict.

Consulting Engineers – Advertising – Competitive Bidding – Contingency Fees – Safety and Client needs – Provision for resolution of Disputes.

Engineers as Expert witness and Advisers – Experts Witnesses in the courts – Abuses – Advisers in Planning and Policy – making – Normative Models of Advisers.

Moral Leadership – Morally Creative Leaders – Participation in Professional Societies Leadership in Communities – Ideals of Voluntary Service.

Concluding Remarks. Integrity and Ingenuity – Citicorp Skyscraper.

Text Books :

1. Mike W.Martin Roland Schinzinger, "Ethics in Engineering – Third Edition", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2003.

ELECTIVE SUBJECTS MEEE704, MEEE705, MEEE804 AND MEEE805

1. Maintenance and Safety Engineering
2. Post Harvest Technology
3. Quality and Reliability Engineering
4. Fuels and Combustion
5. Mechanical Vibrations
6. Fluid Power and Control
7. Microprocessor Technology
8. Plant Layout and Materials Handling
9. Materials Handling and Safety Management
10. Internet and Java Programming
11. Computational Fluid Dynamics

-.-.-.-.-.--.-.--

12. Engine Pollution and Control
13. Industrial Relations and Organisational Development
14. Production and Operations Management
15. Total Quality Management
16. Modeling and Simulation of Dynamic Systems
17. Project Engineering
18. Entrepreneurship and E-Business
19. Product Development and Manufacture
20. Energy Audit and Energy Conservation Methods
21. Waste heat recovery systems and Co- generation

MEEE704, MEEE705, MEEE804 AND MEEE805

1 . MAINTENANCE AND SAFETY ENGINEERING

OBJECTIVES

This subject careers the need for maintenance, types of maintenance, aspect of preventive and brake down maintenance, maintenance of various machines etc., Prevention of accidents, safety aspect of human bodies, protection against fire are also dealt with.

UNIT- I

Need for Maintenance - Types of maintenance - Maintenance organisation charts for large, medium and small size plants - Basic functions of maintenances.

Preventive maintenance - Need for preventive maintenance - starting of Preventive maintenance programme - Equipment record - check list - Inspection - what to inspect - Frequency of inspection aids to good preventive maintenance.

UNIT- II

Maintenance of Ball, Roller and Tapered Bearing - Maintenance of Belt, Chain, Gears, Pulleys, Shafting and Fasteners.

UNIT- III

Maintenance of cranes - Hooks and slings - Industrial trucks - Maintenance of Power Plant Equipments - Centrifugal pumps, fans & blowers.

UNIT- IV

Devices and methods for safeguarding machines - points to be considered in designing the guards - Enclosures, covers and Barricades - Safeguarding of fast and loose pulleys, chain and rope drives, revolving machines, pressure plates and self acting machines - Remote tripping and starting devices.

UNIT- V

Safety Engineering - Accident Prevention - Various steps to accomplish accident prevention - safety measures and safety precaution in workshops - protection of eyes - protection against dangerous fumes - protection against fire - wage incentive to satisfy workman compensation.

Text Books:

1. Morrow, Industrial Maintenance,

Reference Books:

1. Mayard, Industrial Engineering,
2. Agarwal, Machine Building Technology

MEEE704, MEEE705, MEEE804 AND MEEE805

2 POST HARVEST TECHNOLOGY

OBJECTIVES

To understand the theory of grain drying.

To study the concepts and principles of parboiling of paddy, methods storage of paddy, types of rice mills, rice milling machinery, recliners and rice polishers.

To study the various uses of the by products of paddy and husk fired furnaces.

UNIT- I

Grain Drying - Theory and Practice.

Paddy - Needs and Theory of drying of grains - Mechanical dryers - different methods of drying - Factor affecting drying - economics of drying - energy requirements -Drying efficiency - Parboiling of Paddy.

UNIT- II

Basic concepts and principles - advantages of parboiling - methods of parboiling - traditional methods, CFTRI methods, kissan continuous parboiling method, pressure parboiling RFEC method, Hot humid air soaking and parboiling.

UNIT- III

Storage of Paddy - Biological consideration - Insect - principles involved - application of insecticides - control of insects etc. - stored food - physical consideration of storage methods - Control systems.

UNIT- IV

Rice Milling - Types of rice mills, huller rice mill, Sheller huller mill, sheller mill - modernised mills - Rice milling machineries - under runner disc sheller, rubber roll sheller, centrifugal paddy dehusker.

UNIT- V

Cleaning of paddy - pre-cleaners - paddy separators, husk aspirator, rice grader, bran sieve rice polishers, cone polisher, horizontal polisher, jet pearler - Classive plant - Mechanical handling methods.

Husk fired furnaces - different types and their working.

Text Books:

1. Michael A.M. & Ojha T.P., Principles of Agricultural Engineering - Volume I, Jain Brothers, NewDelhi.

Reference Books:

1. Arnallo E.V., Podna D.E. & Michael Graham, Rice Post Harvest Technology, International Development Research Centre.

MEEE704, MEEE705, MEEE804 AND MEEE805

3. QUALITY AND RELIABILITY ENGINEERING

OBJECTIVES

To understand the applications of statistical tools in quality control and the fundamentals of reliability which leads to fault free manufacturing techniques.

UNIT - I

Objectives of statistical quality control - inspecting and its importance - differences between inspection and quality control - theory of control charts, control charts for attributes - p, np, c and u charts.

UNIT - II

Control charts for variables, X bar and R Charts, standard deviation charts median chart and midrange chart. Relationship between statistical control limits and specification limits - modified control chart, process capability studies (Cp and Cpk)

UNIT - III

Acceptance sampling: Fundamental concepts and terms, OC curves. sampling plans - simple, double, multiple and sequential sampling plans. Acceptance Rectification plan (AOQL) - ATI and ASN concepts - AQL and LPTD sampling plan, switching rules for normal, tightened and reduced inspection, Dodge - Romig sampling plans - uses of IS 2500 Part I.

UNIT - IV

Acceptance sampling plans for variables: Variability known and unknown standard deviation method - single and double specification limit - Variability known and unknown range method - single and double specification limit - Introduction to continuous sampling plan (csp) - uses of IS 2500 Part II.

UNIT - V

Reliability: Definition, failure rate, mean time to failure, mean time between failure, hazard rate, life testing - System reliability, series, parallel and mixed configuration - Active, partial and standby redundancy - Availability and Maintainability concepts - Weibull probability plot - Introduction to Fault tree and FMECA.

Text books:

1. Montgomery D.C., Introduction to statistical Quality control, John Wiley, 1994.
2. Gupta R.C., Statistical Quality Control, Khanna Pub.,1998.

Reference Books:

1. Grant E.L., Statistical Quality Control, 1996.
2. Siegmund Halpern, The Assurance Science, PHI, 1978.
3. I.S. 2500 - 1973 Part I and II
4. I.S. 397 - 1970 Part I and II
5. Srinath L.S., Reliability Engineering, Affiliated East West Press, 1991.

MEEE704, MEEE705, MEEE804 AND MEEE805

4. FUELS AND COMBUSTION

OBJECTIVES

To understand the types of fuel, the methods for determining the calorific values of fuels, combustion calculations and the nuances of combustion.

UNIT - I

Fuels – Primary and Secondary - Types of Fuel - Solid – Liquid - Gaseous –Classification of Fuels – Origin of Coal – Theories of Coal - Composition and Characteristics of different Coals – Petrography of Coal – Storage of Coal – Uses of Coal – Selection of Coal –Estimation Calorific Values of Coal – Proximate Analysis - Ultimate Analysis of Coal and Calculations.

UNIT - II

Carbonization of Coal – Types – Physico Chemical Changes during Coal Carbonization – Metallurgical Coke Production – By Product Coke Ovens and Recovery – Characteristics of Indian Coals – Briquetting of Solid fuels.

Origin of Petroleum – Different theories – Classification of Petroleum – Constituents of Petroleum – Indian Crude – Crude Oil Distillation – Properties of Petroleum Products – Specific Gravity – Viscosity – Flash Point – Fire Point – Cloud Point – Pour Point – Freezing Point – Smoke Point - Carbon Residue – Diesel Index – Octane Number – Cetane Number – Emulsification – Oxidation Stability – Acid Value – Color and Flourescence – Sulphur Content – Moisture.

Liquid Fuels from Coal by Hydrogenation/Liquidification – Storage and Handling of Liquid Fuels.

UNIT - III

Gaseous Fuels – Types of Gaseous Fuels – Methane – Wood Gas – Gobar Gas – Sewage Gas – Natural Gas – Liquified Petroleum Gas – Refinery Gas – Producer Gas – Water Gas - Blast Furnace Gas – Coke Oven Gas –Coal Gas.

Comparative study of Solid, Liquid and Gaseous Fuels.

UNIT - IV

Principles of Combustion – Combustion Process – Requirements for Combustion – Major Efficiency Losses – Measurement of Oxygen in the Flue Gas – Requirement of Theoretical air and Excess Air for Combustion – Quick Methods of Combustion Calculations Only – Maximum CO_2 Content in Dry Flue Gas – CO_2 Content of Theoretical Dry Flue Gas – Significance of CO_2% in Flue Gas – Empirical Equations for Calculation of Theoretical Air and Flue Gas Volume – Simple Combustion Calculations.

UNIT-V

Theory of combustions – Flame Characteristics – Flame Structure – Flame Stability – Ignition Temperature of Fuel – Theoretical Flame Temperature – Flame Velocity - Flame propagation – Combustion in S.I. and C.I. Engines – Combustion in Boiler Furnace (No Problems).

Text Books:

1. Om Prakash Gupta, Elements of Fuels, Furnaces and Refractories, Khanna Publishers, 1999.
2. SP Sharma and Chander Mohan, Fuels and Combustion, Tata McGraw-Hill Publishing Company Ltd, 1987.

Reference Books:

1. Brane J.S.S. & King J.G., Fuel: Solid, Liquid and Gaseous, Edward Arnold.
2. Shaha A.K., Combustion Engineering and Fuel Technology, Oxford & ISH
3. Cambel and Jenning, Gas Dynamics, McGraw Hill, 1958.
4. Smith M.L. & Shinson K.W., Fuels and Combustion, McGraw Hill.
5. John B. Heywood , Internal Combustion Engines Fundamentals , McGraw Hill International Editions.

MEEE704, MEEE705, MEEE804 AND MEEE805

5. MECHANIAL VIBRATIONS

OBJECTIVES

This course introduces to the students the different types of vibrations, the causes of vibrations and means of damping it out.

Unit I

Single Degree Freedom:

Damped, Free Vibrations systems – effects of viscous damping – Logarithmic decrement – Coulomb damping.

Unit II

Forced Vibration - constant harmonic excitation – effect of rotating and reciprocating unbalance – Vibration isolation and transmissibility – vibration measuring instruments.

Unit III

Two degree of Freedom Systems:

Principal modes of Vibration -spring mass system. -Double pendulum two rotor system – Vibration of geared systems –combined rectilinear and angular modes-undamped dynamic vibration absorber.

Unit IV

Multi degree freedom systems – influence numbers and Maxwell's reciprocal theorem– Matrix method - stiffness matrix, dynamic matrix– Natural frequencies and principal modes by matrix iteration.

Unit V

Numerical methods for finding natural frequency – Far coupled systems –Rayleigh's approach–Dunkerley's method – Introduction to Finite element method – Standard Eigen value problem –Non standard Eigen value problems – Finite element formulation.

Text Book:

1. Grover G.K. Mechanical Vibrations, Nemchand & Bros., Roorkee, 1993.

Reference Books:

1. TSE S. Morse Ivan & Hinkle T., Mechanical Vibrations, PHI
2. Den Hartog, Mechanical Vibrations American Book Co. London
3. William T. Thomson & Marie Dillon Dahleh, Theory of Vibration with Applications, Fifth Edition, 1998
4. Rao S.S. Mechanical Vibrations, Third Edition, Addison Wesley Publishing Company, New York, 1995.
5. V. Ramamurthi, Mechanical Vibration Practice With Basic Theory- Narosa Publishing house, 2000

MEEE 706, MEEE 707, MEEE 805, MEEE 806, PMEEE 604 AND PMEEE 702

6. ENGINE POLLUTION AND CONTROL

OBJECTIVES

To create an awareness on air pollution due to I.C. engines and its ill effects.

To study the methods of reducing or eliminating the harmful gases from engine and gas turbine exhausts.

To study the different norms and legislations to put a check over the air pollution.

UNIT –I

Atmospheric pollution from internal combustion engines and gas turbines – Global warming – Sources of automotive pollution – fuels – types of hydrocarbons – properties of fuels and testing – fuel additives – diesel and gasoline.

UNIT –II

SI Engine pollution formation, CI engine pollution formation – oxides of nitrogen, , Zendovich mechanism, carbon monoxide, hydrocarbon, aldehydes and different types of smoke, smog, particulate emission, soot formation – effects of pollutions on health and environment.

UNIT –III

Engine component – fuel modification – evaporative emission control – PCV – crank case emission – Air fuel mixture – hot, cold and internal EGR - air injection – thermal reactor – in cylinder control of pollution – catalytic converters – selective catalyst reduction(SCR) – lamda sensor – application of micro – processor in emission control

UNIT –IV

Non-dispersive infrared gas analyser – gas chromatography, Chemiluminescent analyser and flame ionisation detector – smoke measurement – Particulate measurement – high volume sampler – micro dilution tunnel – iso kinetic systems - noise pollution measurement and control methods.

UNIT –V

Use of driving cycles for emission measurement – chassis dynamometer – constant volume sampling (CVS) system – Indian driving cycle – US driving cycle - Japan driving cycle – National and international emission standards.

Text Book:

1. John B Keywood, Internal combustion engines, McGraw Hill.

Reference Books:

1. Crouse William, Automotive emission control, Gregg Division, McGraw Hill, 1971.
2. George, Springer and Donald J Patterson, Engine emissions, pollutant formation and measurement, Plenum press, 1973.
3. Obert E.F., Internal Combustion engines and air pollution, Intext Educational Publishers, 1980.
4. B.P. Pundir, Engine emissions, Narosa publishing house, 2007.

MEEE704, MEEE705, MEEE804 AND MEEE805

7. FLUID POWER AND CONTROL

OBJECTIVES

It deals with the concept of automatic control and its components, modes of control, controller mechanism and control system analysis for system stability and frequency response analysis.

UNIT-I

Introduction: Concept of automatic controls - Open loop and closed loop systems - Servo mechanism - block diagrams - transfer functions.

Translational and rotational mechanical components - electrical components, series and parallel combinations - comparators for rotational and linear motions.

Single loop control, Multi loop control, Supervisory control, Distributed control, Control processor, Application processor, Work station, Field Bus Module and PLC and DCS control.

UNIT-II

Modes of controls: Proportional control - proportional plus reset control - proportional plus rate control - proportional reset control - two position control.

UNIT-III

Controller Mechanisms: Integrating devices - hydraulic servo motor - temperature control system - speed control system.

Pneumatic hydraulic and electric controllers - general principles and circuits for generating various control actions.

UNIT-IV

Control system analysis: System response - First and second order systems - response to step - pulse - ramp and sinusoidal inputs - systems with distance velocity lag.

Transient response of simple control systems - stability of control systems - Routh's criterion.

UNIT-V

Frequency Response Analysis: Polar, rectangular and logarithmic plots - experimental determination of frequency response - Bode and Nyquist stability criteria - gain and phase margins.

Root locus plots of simple transfer functions - transient response from root locus.

Text Books:

1. Benjamin .C. Kuo, Automotive Control Systems, EEE Publications.
2. Peter Harriott, Process Control, 10th edition.

Reference Books:

1. Murphy, Basic Automatic Control Theory, Van Nostrand Pub.
2. Donald P.Eckman, Automatic Process Control, Wiley Eastern Ltd.
3. Peter Dransfield, Engineering Systems and Automatic control, Prentice Hall of India (P) Ltd., New Delhi.
4. George Stephanopoulos, Chemical Process control, 2nd ed.

MEEE704, MEEE705, MEEE804 AND MEEE805

8. MICROPROCESSOR TECHNOLOGY

OBJECTIVES

To give an insight of digital technology

To introduce to the students the microprocessor architecture and programming

To impart knowledge on peripheral and interfacing devices and applications of microprocessor

UNIT- I

Digital Technology Overview:

Number systems - Binary, Hexadecimal, Decimal - Logic gates - OR, AND, XOR, NOT, NAND, NOR gates - Boolean Algebra - DeMorgan's theorem - Karnaugh's Map - Encoders, decoders, adders, multiplexers, demultiplexers - RS, JK, D, T flip flop - Asynchronous counters - shift register.

UNIT- II

Microprocessor architecture:

RAM, ROM, EPROM - memory mapping - INTEL 8085 Architecture - ALU, registers, address bus, data bus, control buses, tristate devices - overview of other 8-bit,16-bit, 32-bit microprocessors (instruction set not included)

UNIT- III

Microprocessor programming:

INTEL 8085 Mnemonic - Data transfer, Arithemetic, Logic, Branching instructions - subroutines - simple programs

UNIT- IV

Interfacing & peripheral devices:

Basic interfacing concepts - 8085 interrupts, 8255 programmable peripheral interface - DMA controller - A/D & D/A conversion.

UNIT- V

Control of pressure, temperature, speed - stepper motor control, process control - Automotive applications - introduction to micro controllers.

Text Books:

1. Mathur A.P., Introduction to microprocessors, Tata McGraw Hill.
2. Ahson S.I., Microprocessors with applications in process control, Tata McGraw Hill.

Reference Books:

1. Gaonkar R.S., Microprocessor Architecture, Programming & Application, Wiley Eastern.
2. Leventhal L.A., Introduction to Microprocessors software and hardware programming, PHI.
3. Barney G.C., Intelligent Instrumentation, PHI.
4. Peatman, Designing with Micro controllers, McGraw Hill.
5. Douglas V. Hall, Microprocessors - Programming & Interfacing, McGraw Hill.
6. Badriram, Fundamentals of Microprocessors and Micro computers, Dhanpat Rai & Sons.

MEEE704, MEEE705, MEEE804 AND MEEE805
9. PLANT LAYOUT AND MATERIALS HANDLING

OBJECTIVES

To impart knowledge to students in the factors to be considered for a plant location, different types of plant layouts and their importance, importance and scope of material handling.

UNIT - I

Plant Location: Factors to be considered - influence of location in Plant layout - Selection of plant site. Consideration in facilities planning and layout. Physical facilities: Equipments required for plant operation. Capacity serviceability and flexibility and analysis in selection of equipments, space requirements, man power requirements.

UNIT - II

Plant layout: Need for layout, types of layout, factors influencing product, process, fixed and combination layout; tools and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models- machine date. Layout planning procedure, visualisation of layout, balancing of fabrication and assembly lines.

UNIT - III

Material handling: Importants and scope, principles of material handling. Planning, Operating and costing principles - types of materials handling systems, factors influencing their choice.

UNIT - IV

Industrial building and utilities: Centralised electrical, pneumatic water line systems. Types of buildings, lighting, heating, air-condition and ventilation utilities planning and maintenance, waste handling, statutory requirements, packing and storage of materials, importance of packaging, layout for packaging - Packaging machinery - wrapping and packing of materials, cushion materials.

UNIT - V

Analysis of material handling: Factors involved, motor analysis, flow analysis, graphic analysis, safety analysis, equipment cost analysis, pelletization analysis for operation, material handling surveys.

Text Books:

1. James M.Apple, Principles of layout and Material handling, Ronald press 1977.

Reference Books:

1. M.Moore James, Plant Layout and Design, Macmillan Co., New York, 1963.
2. R.Muther, Practical Plant Layout, McGraw Hill, 1955.

MEEE704, MEEE705, MEEE804 AND MEEE805

10. MATERIALS HANDLING AND SAFETY MANAGEMENT

OBJECTIVES

It deals with the fundamentals of material handling and its importance, different material handling equipments, introduction to maintenance. It also concerned about the safety aspects in work places.

UNIT - I

Introduction to Material Handling : - Objectives - Limitations. Functions and Principles of Material Handling: Material Handling Equipments - Classification Factors influencing Selection of Equipments.

UNIT - II

Hoists : - Block and tackle - Winch - Power Hoist Elevators - Grabs : Monorail Hydraulic lift crane - Derric. Mobile: Hydraulic Overhead Traveller and Tower Cranes.

Conveyer Equipments :- Belt - Roller - Chain Screw - Elevating, Pneumatic and Vibrating Conveyer.

UNIT - III

Production line equipments :- Types and operating principle : Escapement and gating devices:

Special Material handling equipments:- Ship and barge handling - air cargo handling - handling of bulk materials,

UNIT - IV

Introduction to maintenance - Need for Maintenance Types of Maintenance and function of Maintenance

Maintenance of bearings, conveyers cranes, hoists, industrial trucks.

UNIT - V

Safety Programme in workshops - Accident Prevention - Steps to Safety measures in Factory. Human Protection to hazards. Machinery protection to hazards. Prevention of fire.

Reference Books:

1. Boothroyd and Redford, Mechanised Assembly
2. Rudenko, Material handling Equipment.
3. Morrow, Industrial Maintenance,

MEEE 706, MEEE 707, MEEE 805, MEEE 806, PMEEE 604 AND PMEEE 702

11. INDUSTRIAL RELATIONS AND ORGANISATIONAL DEVELOPMENT

OBJECTIVES

- To introduce the multi dimensional facets of organizational behaviour.
- How the individual dimensions, the group dimensions and its dynamics effect the organizational effectiveness
- Change is inevitable – to impart the importance of change and managing the change in any organizational environment.

Unit I – Industrial Relations

Industrial Relations – Introduction. Significance & conditions for good industrial relations- Causes of poor industrial relations & suggestions to improve it. Labour disputes in India. Industrial disputes act-1947 (only Salient Points). Types of industrial disputes – strikes – Gherao - lockouts. Regulation of strikes & Lockouts. Grievances & collective Bargaining.

Unit II - Individual dimensions of organisational behaviour

Personality predispositions – personality and personality types, Maddi's models of personality. Perpectual process – development of perpectual skills. Motivation and work performance. Reinforcement theory – Relationship between motivation and performance.

Unit III – Interpersonal and Group dynamics

Dynamics of communication – The communication process, structure of communication, Transactional Analysis, The five common communication networks in an organization. Group Dynamics – Synergy through groups, Group behaviour, group effectiveness, stages of group development. Properties and Characteristics of Highly effective groups

Unit IV – Managerial process

Leadership as an influence process – Theories of leadership, leadership effectiveness model. Conflict management – traditional and behavioural views of conflict, conflict resolution modes, A contingency approach to conflict management.

Unit V – Organizational Development & Change

Organisational Development- Objectives – Quality of life, Some frequently used intervention strategies. Managing change process – Three steps in introducing planned change, management of change. Organizational effectiveness – An input – through put – output approach in OE.

Text Books:

1. Uma sekaran – "Organisational Behaviour – Text and Cases" – Tata McGraw Hill New Delhi
2. Tripathi – "Personnel Management & Industrial Relations" - Sultan Chand and Sons New Delhi.

References:

1. Goyal R C & C A Myers- Management of Personnel – Manaktalas –1967
2. Chakraborty S K- Managerial Development & Appraisal –Macmillan India
3. Strauss & Sayles – Personnel Management
4. Harvard Business Review On Human Relations – Harper & Row Publishers New York
5. Indian Journal of Industrial Relations, New Delhi

MEEE704, MEEE705, MEEE804 AND MEEE805

12 INTERNET AND JAVA PROGRAMMING

OBJECTIVES

This course is intended to build up necessary background for understanding the importance of internet.

To impart some fundamental knowledge on HTML and Java programming.

UNIT-I

INTERNET: Introduction-E.mail and mailing Lists-Newsgroups, FTP, X Modem and Kermit-Navigating with Gopher-World Wide Web:-Web, Mosaic, Netscape-Web Browser-WWW Search tools.

UNIT-II

HYPER TEXT MARKUP LANGUAGE (HTML): Introduction to Standard Generalised Markup Language (SGML) - HTML - Document Type Definitions (DTDs)-HTML and Validation-The Common Gateway Interface (CGI)-CGI Input and Output-Designing CGI applications.

UNIT-III

JAVA: Overview-Data types, Variables and Arrays-Operations-Control Statements-Classes-Methods-Inheritance-Packages and Interfaces.

UNIT-IV

Exception Handling - Multithreaded programming - Input / Output - Applets - Scripts Handling - Exploring java language- Utility classes - Exploring java - Networking.

UNIT-V

The Applet class-Introduction to Abstract Window Toolkit (AWT)- Working with Windows, Graphics and Text - AWT controls - Layout Managers- Menus- Images - Animations.

Text Books:

1. Neil Randall, "The Internet", Second Edition, PHI, 1996.

2. Ed Tittle, Marck Gaither, Sebastian Hassinger and Mike Erwin, "Foundations of World Wide Web Programming With HTML and CGI",Comdex Computer Publishing,1996.

3. Patrick Naughton and Herbert Schildt., "The Complete Reference JAVA", (OBSORNE series) TATA McGraw-Hill Publishing Limited, 1997.

Reference Books:

1. Douglas E.Comer "The Internet", Second Edition, PHI, 1997.
2. Robert Ainsley, "Get Smart in Internet", Pusthak Mahal, First edition, 1996.
3. Michael D.Thomas, Pratik R.Patel, Alan D.Hudson and Donald A.Ball J.R. "Java Programming for the Internet ! A Guide to Creating dynamic, interactive Internet applications", Ventana Communications Group Inc, 1996.
4. Alexis Leon and Mathews Leon "Internet for every one", Vikas Publishing, 1998.

MEEE704, MEEE705, MEEE804 AND MEEE805
13. PRODUCTION AND OPERATIONS MANAGEMENT

OBJECTIVES

To provide an understanding of the modern approaches to manage the operations, and to present a broad conceptual frame work for the management of the operations functions in an organization.

UNIT - I

Types of Production systems - Elements of Production Planning and Control - Process planning - Routing - Route sheets - Machine loading and scheduling - Scheduling charts and graphs - Forward Scheduling and backward scheduling, methods of Scheduling - Perpetual, periodic and order Scheduling - Dispatching - Expediting.

Aggregate planning: Costs, Strategies - Graphical and charting methods, Transportation method - Simple problems.

UNIT - II

Forecasting - Uses of sales and demand forecasting in planning - components of demand, Qualitative Vs Quantitative methods of forecasting - moving average method - single and double exponential smoothing method - Simple linear regression model measures of accuracy.

UNIT - III

Inventory planning and control : Need, inventory costs, Determination of EOQ, EPQ/ELS (without shortages) - Effect of quantity discounts.

Determination of ROL, Safety stocks - Methods of calculating safety stock using Normal and Poisson distribution - single period inventory model, Inventory control systems - P, Q, and S-s System - selective inventory control techniques.

UNIT - IV

Materials Requirement Planning (MRP) - master production schedule, Bill of materials, MRP concepts, lot sizing - lot-for- lot technique, EOQ approach, silver - meal approach, period order quantity approach, least unit cost approach, least total cost approach, Wagner-whiten algorithm - part period balancing.

UNIT - V

Operations scheduling : Notations and definitions - criteria and objective functions for scheduling - Job shop scheduling - sequencing of n job through one machine - Priority decision rules, n jobs through 2 machines - Jackson's rule. Flow shop scheduling - sequencing of n jobs through 2,3 machines, Hohnsons's rule. N jobs through m machines - CDS algorithm, Palmer's rule, Dannenbring algorithm – Multiproduct sequencing – Indicator method.

Text Books:

1. Monks G.J., Operations Management, McGraw Hill, 1987.
2. Chary S.N., Theory and Problems in Production and Operations Management, TMH, 1995.

Reference Books:

1. Aquileno et al., Fundamentals of Operations Managements, Irwin, 1995.
2. Hicks P.E., Industrial Engineering and Management, McGraw Hill, 1994.
3. Adam E.E. and Ebert R.J., Production and Operations Management, PHI, 1992.
4. Riggs L.J., Production Systems, Planning, Analysis and Control, John Wiley, 1986.
5. Jay Heizer & Barry Render, Production and Operations Management, Prentice Hall Inc., 4th edition, 1996

.

MEEE704, MEEE705, MEEE804 AND MEEE805
14. COMPUTATIONAL FLUID DYNAMICS

Objective:

This course is intended to introduce to the students the basics of CFD, governing equations, methods of solution of finite difference equation. Different type of grids and finite volume method to introduce numerical modeling and its role in the field of heat transfer and fluid flow.

UNIT – I

Basic concepts of fluid flow – derivation of the governing equations, conservation of mass, momentum and energy. Mathematical classification of flow – hyperbolic, parabolic, elliptic and mixed flow types.

UNIT – II

Finite difference method – forward, backward and central difference schemes, explicit and implicit methods. Properties of numerical solution methods – stability analysis, error estimating.

UNIT – III

Choice of grid, grid oriented velocity components, Cartesian velocity components, staggered and collocated arrangements, adaptive grids.

UNIT – IV

Lax – Wendroff technique – MacCormack's technique, relaxation technique. Artificial viscosity, ADI technique, Pressure correction technique.

UNIT – V

Introduction to Finite Volume Method, difference between the Finite Difference Method and Finite Volume Method. FVM formulate SIMPLE algorithm. Upwind schemes – flux vector splitting. Introduction to Turbulence Modeling , turbulence energy equations.

Text Books:

1. John D. Anderson, " Computational Fluid Dynamics – The Basics with Applications", McGraw Hill, New york, 1995.
2. Versteeg H K and Malalasekara W. "An Introduction to Computational Fluid Dynamics – The Finite Volume Method Longman, 1995

Reference Books:

1. Muralidhar K. and Sundararajan T , "Computational Fluid Flow and Heat Transfer" Narosa Publications, New Delhi, 2003.
2. Chung T J "Computational Fluid Dynamics", Cambridge University Press, London, 2002
3. David C Wicox, "Turbulence Modeling for CFD", DCW industries, Inc, 1993

MEEE704, MEEE705, MEEE804 AND MEEE805

15. TOTAL QUALITY MANAGEMENT

OBJECTIVE:

To provide the statistical foundation on modern methods of quality control and management,which are used in manufacturing and service industries.

UNIT – I

INTRODUCTION: Definitions of the terms – quality, quality planning, quality control, quality assurance, quality management, Total Quality Management (TQM) as per ISO 8402 – overview on TQM – The TQM axioms – Commitment – Scientific knowledge – Involvement – Consequences of total quality.

THE DEMING APPROACH TO TQM: Deming's fourteen points on quality management – five DDs – implementing the Deming philosophy – action plan – the Deming cycle – questions and opinions of Deming.

UNIT – II

JURAN ON QUALITY: Developing a habit of quality – Juran quality trilogy – the universal break through sequence – comparison Juran and Deming approaches.

CROSBY AND THE QUALITY TREATMENT: Crosby's diagnosis of a troubled company – Crosby's quality vaccine – Crosby's absolutes for quality management – Crosby's fourteen steps for quality improvement.

UNIT – III

KAIZEN: Meaning – Kaizen and innovation – the Kaizen management practices – total quality control (TQC) – approaches of Faigenbaum, Ishkawa – Kaizen and TQC – Kanban systems –small group activities – quality control circles – suggestion systems - comparison of Kaizen and Deming's approach.

UNIT – IV

SUPPORTING TOOLS, ACTIVITIES AND TECHNIQUES IN TQM PROJECTS: Affinity diagram – bar chart – block diagram – brainstorming- cause and effect analysis – customer – supplier reletionship checklist – decision analysis – flow charts – force field analysis – line graph/run charts – Pareto analysis – quality costing – Quality Function Deployment (QFD) – quality project approach and the problem solving process.

UNIT – V

ISO 9000 SERIES QUALITY SYSTEM STANDARDS: The structure of ISO 9000 series quality system standards – certification process – action plan development for cases.

Text Books:

1. Logothetics N., "Managing for Total quality – From Deming to Taguchi and SPC", Prentice Hall Ltd, New Delhi, 1997
2. Juran J.M. & Gryna, F.M. "Quality Planning and Analysis – From Product Development Through Use" Tata McGraw Hill Publishing Limited, New Delhi, 3rd Edition, 1995.

References:

1. Deming W.E., 'Out of the Crisis,' MIT press, Cambridge, MA, 1982
2. Juran J.M., Juran on "Leadership for Quality" – An Executive Handbook, The Free Press, New York, 1989.
3. Salor J.H., "TQM- field Manual" Mc Graw Hill, New York, 1992
4. Crosby P.B, "Quality is Free," McGraw Hill, New York, 1979.

MEEE704, MEEE705, MEEE804 AND MEEE805

16. MODELING AND SIMULATION OF DYNAMIC SYSTEMS

Objective:

To provide an understanding of the modeling and simulation of various dynamic systems like mechanical system, fluid system, and thermal system

UNIT – I

INTRODUCTION TO MODELING AND SIMULATION OF DYNAMICS SYSTEMS: Definitions. Modeling of dynamic systems – formulation of models. Solution of the differential equations. Typical input or test signals. Engineering system similarity.

UNIT – II

MODELING OF MECHANICAL SYSTEMS: Translational systems, rotational systems, systems of combined translational and rotational elements. D Alembert's principle, langrange's equation.

UNIT – III

FLUID SYSTEMS: Properties of fluids, Reynolds number effects, derivation of passive compounds.

THERMAL SYSTEMS: Basic effects, static thermal effects and dynamic thermal effects.

MIXED DISCIPLINE SYSTEMS: Electromechanical systems, fluid mechanical systems, electro-hydraulic position servo.

UNIT – IV

FREQUNCY RESPONSE AND TIME RESPONSE: Introduction, first-order systems, second order systems, higher – order systems, alternation forms of systems description.

UNIT – V

DIGITAL SIMULATION: Euler's method, Runge – Kutta methods, system of equations – selections of the step size – variable step size – variable step size methods. Solution of non-linear differential equations.

Text Book:

1. Woods / Robert and Lawrence / Kent, "Modeling and simulation of Dynamic Systems," Prentice Hall, New Jersey, 1997

Reference:

1. Chad Phillip et.al, "Fundamentals of Medeling and Analysing Engineering Systems", Cambridge University Press, London, 2000.

MEEE704, MEEE705, MEEE804 AND MEEE805
17. PROJECT ENGINEERING

Objective:

To provide an understanding of the various compounds of project engineering such as fore casting replacement analysis and risk analysis.

UNIT – I

PROJECT FEASIBILITY ANALYSIS: Marketing, technical financial feasibilities, case studies, report preparation.
PROJECT MANAGEMENT: Nature,scope, different phases of project – phased manufacturing plan (PMP), semi knock down (SKD), completely knock down (CKD), totally integrated project management techniques PERT, CPM, principles, applications.

UNIT – II

INTEREST AND TIME VALUE OF MONEY: Simple interest, compound interest, uniform series payments, interest factors, use of interest tables, nominal and effective interest rates, continuous compounding, uniform continuous payment – uniform gradient.
DEPRECIATION: Reasons for depreciation, causes of declining values, depreciation methods, comparison with and without accounting of time value of money.

UNIT – III

METHODS OF TANGIBLE EVALUATION OF ALTERNATIVES: Equivalent annual worth comparisons, present worth comparisons, equal, un-equalized, capitalized cost, rate of return comparisons.
METHODS OF FORECASTING: Need for forecast – methods of forecasting, time series analysis method of least squares, moving average method, curvilinear trend, correlation analysis, exponential smoothing.

UNIT – IV
REPLACEMENT ANALYSIS: Items deteriorating with time and items that fail completely, not accounting for time value of money and with accounting for time value of money, replacement policy for new and old machine with infinite horizon, group replacement.

UNIT – V
RISK ANALYSIS: Risk in economic analysis, measuring risk investment, risk profiles, decision trees, formulation of discounted decision tree, simulation.

Text Books:

1. Prasanna Chandra, " Projects", Tata McGraw Hill, New Delhi, 2002
2. James L Riggs, "Engineering Economics", Tata McGraw Hill Book Co., New Delhi, 2004

References:

1. Noman N. Barish, "Economic Analysis for Engineering", McGraw Hill Book Company, New York, 1978
2. James L.Pappas and Eugene F Brigham, "Managerial Economics", Holt, Rinehaut and Winston Ltd., 1983.

MEEE 706, MEEE 707, MEEE 805, MEEE 806, PMEEE 604 AND PMEEE 702

18. ENTREPRENEURSHIP and E-BUSINESS

Objective

- Develop an entrepreneurial Spirit among the students.
- Help the participants to identify business opportunities within an organization or independently
- To explain the functional areas in a SME

UNIT I – Introduction & Idea Generation

Introduction entrepreneurship - definition, nature and importance. Theories of entrepreneurship. Types and barriers to entrepreneurship. Corporate entrepreneurship. Entrepreneurs versus Managers. Motivation converting dream to reality. Role of networks. Entrepreneurship – emerging scenario.

Entrepreneurship and Innovation. Innovation and managing innovation. The role of incubation in innovation. Innovation diffusion. Idea to an entity – Business ideas and opportunity recognition. Idea generation workshop.

UNIT II – Functional areas

The market for the product. Products and markets negotiation skills. IT for entrepreneurs. People issues in entrepreneurship. Ethics for entrepreneurs. Financing the new business – venture capitalists, financial institutions and banks.

UNIT III –Labour laws & Development organizations

The Factories Act 1948, Payment of wages Act 1936, Workmen compensation Act 1936, Taxation – State & Central Government.

World Trade Organization (WTO), World Intellectual Property Organization (WIPO), Trade Related Aspects of Intellectual Property Rights (TRIPS). Technology acquisition and Intellectual property rights (IPR). Role of agencies involved in promoting and assisting SSI units and Facilities offered.

UNIT IV – Business Plan

Objectives of business Plan, Contents – Executive summary, product / service and competition, Seven Domains Model by John Mullins - Major sections – measurement of objectives, market analysis, micro environmental influences, financial analysis, management analysis, human resource analysis. Critical risk and contingencies. Summary and conclusions.

UNIT V – E – BUSINESS

Introduction to e-business, Concepts and definition, different types of e-commerce. Relevent components of e-commerce model. E-commerce applications – Issues and prospects – EPS, e-banking, e-tailing. E-commerce in SME's of developing countries.

Text book:

1. Entrepreneurship by Hisrich (5th Edition) Tata Mc Graw Hill , New Delhi.

References:

1. Entrepreneurship by Madhurina Lall & Shikha Sahai – Excel Books New Delhi
2. Handbook of entrepreneurship by Sexton and Landstrom
3. Innovation and entrepreneurship by Peter Drucker – HBR Publication
4. Small Business Management by William L Megginson McGraw Hill (International)
5. Entrepreneurship in the new millennium by Kondaiah – Tata Mc Graw Hill
6. New Venture Creation by Jeffry A Timmons - McGraw Hill (International)

Web Sites

www.Entrepreneurship.com
www.ncoe.org
www.nfte.com
www.icsb.org
www.esbri.se
www.Entrepreneurship.mit.edu
www.Entrepreneurship.hbs.edu
www.entireworld.com
www.Entrepreneurship.berkeley.edu
www.smeindia.com
www.sidbi.com

MEEE704, MEEE705, MEEE804 AND MEEE805
19. PRODUCT DEVELOPMENT AND MANUFACTURE

Objective

To provide an understanding of various compounds of Product development and manufacture such as product analysis, trends in product development, engineering materials, assembly and finishing techniques, manufacturing components and processes.

UNIT –I
PRODUCT ANALYSIS: Consumer- industrial products, demand and quality of production, life cycle, cost, quality and service aspects. Component classification, make or buy decision. Group technology, introduction to concurrent engineering.

UNIT-II
LATEST TRENDS IN PRODUCT DEVELOPMENT : Internet, collaborative product commerce, concept, functionalities and implementation, software for CPC.
PROTOTYPE PRODUCTION: Prototype development, assembly and testing, analysis for production and quality. Introduction to rapid prototyping.

UNIT-III
ENGINEERING MATERIALS: Use of standard sections and components, review of different materials and its properties like machinability, hardenability, weldability, formability, use of standard assembly (sub modular assembly).
ASSEMBLY AND FINISHING TECHNIQUES: Types of fasteners, types of joints. Assembling methods-site assembly (ship building), group assembly and line assembly.

UNIT-IV
MANUFACTURE OF CYLINDRICAL COMPONENTS: Components like pins, shafts, hubs and wheels, use of turret, automatic and numerical control turning centres.
MANUFACTURE OF PRISMATIC COMPONENTS: Methods of loading, holding, sequence of operation ,inspection of gear box body, headstock, gear pump body. Applications on milling machines, special purpose machines, transfer lines and machining centres.

UNIT –V
MANUFACTURING OF COMPONENTS BY FORMING: Need for forming process, die casting, injection molding, extrusion and cold heading with examples of components. Manufacturing of sheet metal components. Selection of press, selection of material for blanking and piercing dies, manufacturing of components like circlip, cups, control panel and cabinets.

Text Books:
1. Chitale A K and Gupta RC, “Production Design and Manufacture,” Prentice Hall of India, New delhi 1997.
2. Rod Black, “Design and Manufacture- An Integrated Approach “- Macmillan Publishing Company, London.

References:
1.Michael.P.Groover, “Automation, Production System and Computer Integrated Manufacturing”, Prentice Hall , New Jersey, 1980.

MEEE704, MEEE705, MEEE804 AND MEEE805

20. ENERGY AUDIT AND ENERGY CONSERVATION METHODS

Objective

To provide an understanding of Energy audit and Energy conservation methods in boilers, furnaces, refrigeration system and electrical systems.

UNIT-I

ENERGY AUDIT: Introduction and types of audit-energy conservation measures. Energy efficient technologies-specific energy consumption and norms.

ENERGY AUDIT IN BOILERS: Industrial boilers and performance evaluations- analysis of energy losses and identification of energy conservation.

UNIT-II

ENERGY AUDIT IN INDUSTRIAL FURNACES: Different types of industrial furnaces and efficiency evaluation of furnaces, steady state and unsteady state operation. Energy conservation measures in furnaces-waste heat recovery and selection of refractories. Use of ceramic fibers and insulating refractories.

UNIT-III

REFRIGERATION SYSTEMS: Single stage and multiple stage systems-temperature control, compressor control, optimization, chilled water systems.

UNIT-IV

EVAPORATION AND DISTILLATION: Evaporating systems, material and energy balance, entropy analysis, control systems, steam management, condenser controls, distillation. Material-balance relationships-separation, entropy analysis. Energy recovery and conservation techniques, heat pump and compressor expander systems for distillation. Regenerative heat recovery-double-effect operation and coupling of columns.

UNIT –V

ELECTRICAL ENERGY AUDIT : Motors and efficient-part load operations power factor improvement, use of variable speed drive. Energy efficient lighting system. Energy audit in pumps, fans and compressors.

Text Books:

1.Francis G Shinskey, “Energy Conservation Through Control”, Academic Press,1978.
2.Tripathy S C, “Electrical Energy Utilisation and Conservation”,1987.

References:

1.Diamant R M E, “Energy Conservation Equipment”, Nichols Publishing Company,1984.
2.Davi Hu, “Hand Book of Industrial Energy Conservation”, 1987.

MEEE704, MEEE705, MEEE804 AND MEEE805
21. WASTE HEAT RECOVERY SYSTEMS AND CO-GENERATION

Objective:

It deals with the difference cogeneration schemes and techno economics of co generation. It introduces difference ways heat recovery systems and thermodynamics aspects of waste heat recovery.

UNIT-I
CO-GENERATION: Introduction- principles of thermodynamics, combined cycles, topping, bottoming, organic rankine cycles, advantages of cogeneration technology.

UNIT-II
APPLICATION AND TECHNO ECONOMICS OF COGENERATION: Cogeneration application in various industries like cement, sugar mill, paper mill etc. Sizing of waste heat boilers-performance calculations, part load characteristics, selection of co-generational technologies-financial considerations- operating and investments-costs of co-generation.

UNIT-III
WASTE HEAT RECOVERY: Introduction-principles of thermodynamics and second law-sources of waste heat recovery-diesel engines and power plant.

UNIT-IV
WASTE HEAT RECOVERY SYSTEMS: Recuperators, regenerators, economizers plate heat exchangers. Waste heat boilers-classification, location, service conditions and design considerations. Unfired combined cycle, supplementary fired combined cycle, fired combined cycle.

UNIT – V
APPLICATIONS AND TECHNO ECONOMICS: Applications in industries-fluidized bed heat exchangers, heat pipe exchangers-heat pumps and thermic fluid heaters. Selection of waste heat recovery technologies-financial considerations, operations and investment costs of waste heat recovery.

Text Books:
1. Charles H Butler, “Co-generation”, Mc Graw Hill, New York,1984.
2. Horlock J H, “Co-generation-Heat and Power, Thermodynamics and Economics”, Oxford, UK, 1987.
3. “Institute of Fuel, London, Waste Recovery”, Chapman and Hall Publishers, London,UK, 1963.
4. Sengupta Subrata, Lee SS EDS, “Waste Heat Utilization and Management”, Washington,USA,1983.

References:
1. Robert Noyes, “Cogeneration of Steam and Electric Power, Energy Technology Review”, Vol:29, Noyes Data corporation, 1978.
2. Stecher P G “Industrial and Institutional Waste Heat Recovery Energy, Technology Review”, No:37, Noyes Data Corporation 1978.

ANNAMALAI UNIVERSITY

B.E. DEGREEE COURSE (Part – time)

REGULATIONS

1. Condition for Admission:

Candidates for admission to First year of the $3\frac{1}{2}$ years B.E. Degree course by part-time shall be required to have passed the Diploma Examination in the appropriate branch conducted by the State Board of Technical Education of Tamilnadu of its equivalent examination accepted by the Syndicate of this University. They shall satisfy the conditions regarding eligibility norms as may be prescribed by the Syndicate of the Annamalai University from time to time.

2. Eligibility for the degree:

A pass in a Diploma Course in any of the appropriate branch Civil/Mechanical/Electrical/Electronics/Instrumentation/Chemical branches of Engineering conducted by the State Board of Technical Education of Tamilnadu or its equivalent examination with 3 years professional experience in a recognized industry or organization after passing the Diploma examination.

The admission is restricted to those working or residing within a radius of 75 km from Annamalainagar. The application should be sent through their employers.

However the advance copy with all documents complete in all respects should be received before the prescribed last date. The application through proper channel to be received before entrance test.

3. Branches of study in B.E.

BRANCH I	- Civil Engineering.
BRANCH II	- Civil and Structural Engineering.
BRANCH III	- Mechanical Engineering.
BRANCH IV	- Mechanical Engineering (Manufacturing).
BRANCH V	- Electrical and electronics Engineering.
BRANCH VI	- Electronics and Instrumentation Engineering.
BRANCH VII	- Chemical Engineering.

4. Subject of study:

The subjects of study and syllabus for the subjects are given separately.

5. Scheme of Examinations:

The scheme of Examinations is given separately.

6. Choice Based Credit System

Each course is normally assigned one credit per period of lecture/tutorial per week and one credits for two periods or part thereof for laboratory or practical or drawing per week.

Each semester curriculum shall normally have a blend of theory and practical courses. The total credits for the entire degree course will be 135. For the award of the degree a student has to earn a minimum of 135 credits.

7. Duration of the programme

A student is normally expected to complete the B.E. programme in $3\ ^{1}/_{2}$ years but in any case not more than eight years from the time of admission.

8. Registration for courses

A newly admitted student will automatically be registered for all the courses prescribed for the first semester without any option.

Every other student shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the Dean on the recommendation of the Head of the Department along with a late fee will be done up to the last working day.

Registration for the project work shall be done only for the final semester.

9. Assessment

The break-up of assessment and examination marks for theory subjects is as follows.

First assessment	: 10 marks
Second assessment (mid-semester test)	: 20 marks
Third assessment	: 10 marks
Examination	: 60 marks

The break-up of assessment and examination marks for practical subjects is as follows.

First assessment (test)	: 15 marks
Second assessment (test)	: 15 marks
Maintenance of record book	: 10 marks
Examination	: 60 marks

The project work will be assessed for 40 marks by a committee consisting of the guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the chairman by the Head of the Department. The Head of the Department may himself be a member or the chairman. 60 marks are allotted for the project work and viva voce examination at the end of the seventh semester.

10. Student Counsellors

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Head of the Department.

11. Class Committee

For each of the semesters, separate class committees will be constituted by the respective Heads of Departments.

The composition of the class committees from first to seventh semester will be as follows.

Course co-ordinators of the common courses, if any, who shall be appointed by the Head of the Department from among the staff members teaching the common course.

A project co-ordinator (in the seventh semester committee only) who shall be appointed by the Head of the Department from among the project supervisors.

Teachers of other individual courses.

One Professor or Reader, preferably not teaching the concerned class, appointed as chairman by the Head of the Department. The Head of the Department may opt to be a member or the chairman.

The class committee shall meet four times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the first and third assessments and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The second assessment will be the mid-semester test. The third meeting will be held within a week after the second assessment is completed to review the performance and for follow-up action.

The fourth meeting will be held after all the assessments except the examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 40 marks will be finalised for every student and tabulated and submitted to the Head of the Department for approval and transmission to the Controller of examinations.

12. Withdrawal from a course

A student can withdraw from a course at any time before a date fixed by the Head of the Department prior to the second assessment, with the approval of the Dean of the faculty on the recommendation of the Head of the Department.

13. Temporary break of study

A student can take a one-time temporary break of study covering the current year/semester and/or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid semester test. However, the student must complete the entire programme within the maximum period of eight years.

14. Substitute assessments

A student who has missed, for genuine reasons accepted by the Head of the department, one or more of the assessments of a course other than the examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the fourth meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

15. Attendance requirements

To be eligible to appear for the examination in a particular course, a student must put in a minimum of 80% of attendance in that course. However, if the attendance is 75% or above but less than 80% in any course, the authorities can permit the student to appear for the examination in that course on payment of the prescribed condonation fee.

A student who withdraws from or does not meet the minimum attendance requirement in a course must re-register for and repeat the course.

16. Passing and declaration of examination results

All assessments of all the course on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average and cumulative grade point average, and prepare the grade cards.

90 to 100 marks	: Grade 'S'
80 to 89 marks	: Grade 'A'
70 to 79 marks	: Grade 'B'
60 to 69 marks	: Grade 'C'
55 to 59 marks	: Grade 'D'
50 to 54 marks	: Grade 'E'
Less than 50 marks	: Grade 'F'
Insufficient attendance	: Grade 'I'
Withdrawn from the course	: Grade 'W'

A student who obtains less than 24 marks out of 60 in the examination or is absent for the examination will be awarded grade 'F'.

A student who earns a grade of S,A,B,C,D or E for a course is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who obtains letter grade F in a course has to reappear for the examination in that course.

A student who obtains letter grades I or W in a course must reregister and repeat the course.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; F – 0

Courses with grades I and W are not considered for calculation of grade point average or cumulative grade point average. F grade will be considered for computing GPA and CGPA.

A student can apply for retotalling of one or more of his examination answer papers within a week from the date of issue of grade sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of examinations with the recommendation of the Head of the Department.

After results are declared, grade cards will be issued to the students. The grade card will contain the list of course registered during the year/semester, the grades scored and the grade point average(GPA) for the year/semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the year/semester, divided by the sum of the number of credits for all courses taken in that year/semester. CGPA is similarly calculated considering all the courses taken from the time of admission.

The results of the final semester will be withheld until the student obtains passing grade in all the subjects of all earlier semesters.

After successful completion of the programme, the degree will be awarded with the following classifications based on CGPA.

For First class with Distinction the student must earn a minimum of 135 credits within $3^1/_2$ years from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First class the student must earn a minimum of 135 credits within four years from the time of admission and obtain a CGPA of 6.75 or above.

For Second class the student must earn a minimum of 135 credits within eight years from the time of admission.

17. Ranking of candidates:

The candidates who are eligible to get the B.E. degree in First Class with distinction will be ranked together on the basis of the percentage of marks obtained by them in all the subjects of study from III to VIII semester.

The candidates passing with First class will be ranked next after those with distinction on the basis of the percentage of marks obtained by them in all the subjects of study from III to VIII Semester.

The ranking will be done separately for each branch of study.

18. Electives

Apart from the various elective courses offered in the curriculum of the branch of specialisation, a student can choose a maximum of two electives from any specialisation under the faculty during the entire period of study, with the approval of the Head of the Department and the Head of the Department offering the course.

19. The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the subjects of study and the syllabi from time to time.

20. Transitory Regulations

Wherever there had been change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive times after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendations of the Head of the Department concerned.

SUBJECTS OF STUDY AND SCHEME OF EXAMINATIONS

BACHELOR OF ENGINEERING (MECHANICAL) – PART-TIME
(4 Year Degree Course)
CHOICE BASED CREDIT SYSTEM (CBCS)

FIRST SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
PMEEC 101	Mathematics – I	4	--	--	--	3	40	60	100	4
PMEEC 102	Engineering Mechanics	4	--	--	--	3	40	60	100	4
PMEEC 103/MEEC 303	Thermodynamics	4	--	--	--	3	40	60	100	4
PMEEC 104/MEEC 403	Fluid Mechanics	4	--	--	--	3	40	60	100	4
PMEEC 105/MEEC 601	Power Plant Engg.	4	--	--	--	3	40	60	100	4
	Total	20	--	--	--		200	300	500	20
								Cumulative		20

SECOND SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credits
		L	T	P	D		Sess.	Exam	Total	
PMEEC 201	Mathematics – II	4	--	--	--	3	40	60	100	4
PMEEC 202/MEEC 306	Mechanical Measurements and Control	4	--	--	--	3	40	60	100	4
PMEEC 203/MEEC 404	Machine Design-I	4	--	--	--	3	40	60	100	4
PMEEC 204/MEEC 405	Mechanics of Machines-I	4	--	--	--	3	40	60	100	4
PMEEC 205	Electronics	4	--	--	--	3	40	60	100	3
	Total	20	--	--	--		200	300	500	19
								Cumulative		39

THIRD SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credit Points
		L	T	P	D		Sess.	Exam	Total	
PMEEC 301/MEEC 402	Heat Engineering-I	4	--	--	--	3	40	60	100	4
PMEEC 302/MEEC 504	Hydraulics and Pneumatics	4	--	--	--	3	40	60	100	4
PMEEC 303/MEEC 505	Machine Design-II	4	--	--	--	3	40	60	100	4
PMEEC 304/MEEC 602	Engineering Metallurgy	4	--	--	--	3	40	60	100	4
PMEEC 305	Production Technology	4	--	--	--	3	40	60	100	4
	Total	20	--	--	--		200	300	500	20
								Cumulative		59

FOURTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration of exam Hrs.	Marks			Credit Points
		L	T	P	D		Sess.	Exam	Total	
PMEEC 401/MEEC 501	Numerical Methods	4	--	--	--	3	40	60	100	4
PMEEC 402/MEEC 502	Mechanics of Machines-II	4	--	--	--	3	40	60	100	4
PMEEC 403/MEEC 503	Heat Engines-II	4	--	--	--	3	40	60	100	4
PMEEC 404/MEEC 507	Industrial Engg. & Mgt.	4	--	--	--	3	40	60	100	4
PMEEC 405/MEEC 606	Turbo machinery	4	--	--	--	3	40	60	100	4
	Total	20	--	--	--		200	300	500	20
								Cumulative		79

FIFTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration Of exam Hrs.	Marks			Credit Points
		L	T	P	D		Sess.	Exam	Total	
PMEEC 501/MEEC 603	Automotive Engg.	4	--	--	--	3	40	60	100	4
PMEEC 502/MEEC 604	Operations Research	4	--	--	--	3	40	60	100	4
PMEEC 503/MEEC 701	Heat and Mass Transfer	4	--	--	--	3	40	60	100	4
PMEEE 504	Elective – I*	4	--	--	--	3	40	60	100	4
PMEEP 505	Mechanical Engg. Lab-I		--	3	--	3	40	60	100	4
	Total	16	--	3	--		200	300	500	20
								Cumulative		99

SIXTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration Of exam Hrs.	Marks			Credit Points
		L	T	P	D		Sess.	Exam	Total	
PMEEC 601/MEEC 605	Ref. & Air-conditioning	4	--	--	--	3	40	60	100	4
PMEEC 602/MEEC 801	CAD/CAM/CIM	4	--	--	--	3	40	60	100	4
PMEEC 603/MEEC 802	Mechatronics	4	--	--	--	3	40	60	100	4
PMEEC 604	Elective - II*	4	--	--	--	3	40	60	100	4
PMEEP 605	Mechanical Engg. Lab-II		--	3	--	3	40	60	100	2
	Total	16	--	3	--		200	300	500	18
								Cumulative		117

SEVENTH SEMESTER

Course Code	Courses	Periods of Instructions per week				Duration Of exam Hrs.	Marks			Credit Points
		L	T	P	D		Sess.	Exam	Total	
PMEEC 701/MEEC 703	Renewable Energy Sources	4	--	--	--	3	40	60	100	4
PMEEE 702	Elective – III*	4	--	--	--	3	40	60	100	4
PMEEE 703	Elective – IV*	4	--	--	--	3	40	60	100	4
PMEET 704	Project Work	--	4	--	--					
	Viva-voce	--	--	--	--	3	40	60	100	6
	Seminar	--	2	--	--					
	Total	12	6	--	--		160	240	400	18
								Cumulative		135

***Elective subjects common with B.E (Mech.) full – time.**

FOR ALL SUBJECTS EXCEPT *PMEEC 101, PMEEC 102, PMEEC 201, PMEEC 205, PMEEC 305, PMEEC 505* AND *PMEEC 605* THE SYLLABI ARE SAME AS THAT OF FULL-TIME STREAM

PMEEC 101 MATHEMATICS –I

Objective

The course is aided at developing the skills of engineering students in the basics of chosen topics of mathematics that are necessary for effective understanding of engineering subjects.

Unit – I

Inverse of fourth order matrix by elementary transformation and partitioning methods – characteristic equation – Cayley Hamilton theorem (Statement only) and its application in finding the inverse of a matrix - eigen values and eigen vectors and their properties – real quadratic forms – reduction in to canonical form by elementary congruent transformations.

Unit – II

Differential Calculus: Functions of two or three variables (revision of partial differentiation) total differentiation – errors and approximations – envelops – Jacobians – functional relationship – Taylor's series and Maclaurin's series expansions functions of two variables – maxima and minima of functions of two undetermined multipliers.

Unit – III

Three dimensional analytical geometry: Rectangular, Cartesian coordinates – direction cosines of a line – angle between two lines – conditions for perpendicularity and parallelism – different forms of equations of plane – angle between two planes – conditions of perpendicularity and parallelism – equations of a plan through the intersection of two given planes – symmetric form of equations of line – plane and straight line – coplanar lines – skew lines.

Unit – IV

Equation of a sphere – circle as the plane – section of sphere – equation of sphere passing through a given circle – equation of a cone having its vertex origin of a given point and passing through a plane curve – right circular cone.

Unit – V

Integral Calculus: Integration by parts – properties of definite integral – Reduction formulae – Evaluation of double and triple integrals change of order of integration – Application of multiple integrals for finding areas and volumes – Beta and gamma functions.

Text Books:

1. Dr. M.K. Venaktaraman, engineering Mathematics (Series) National Publishing Co., Chennai-2005.
2. Narayanan S. Manicavachagam Pillai T.K,. and Ramanaigh G, Advanced Mathematics for Engineering Students Vol. – I, S. Viswanathan Printers and Publishers Pvt. Ltd. Chennai., 2000.

3. Dr. S. Arumugam & others, Engineering Maths series, Meenakshi Publications, Chennai., 2005.

References:

1. Dass H.K. Engineering Mathematics, S Chand & Co. New Delhi, 2005.
2. Dr. K. Vairamanickam & others, Engineering Maths Vol.-1 Prentice Hall of India New Delhi-1, 2006.

PMEEC 201 MATHEMATICS –II

Objective

The course is aided at developing the skills of engineering students in the basics of chosen topics of mathematics that are imperative for effective understanding of engineering subjects.

Unit – I

Trignometry: Expansion of sin nx and cos nx in terms of cosines and sines of multiples of x – expansion of sin nx and cos nx in series of powers of sin nx and cos nx – Expansion of sin nx and cos nx and tan nx in series of ascending power of x – Evaluation of indeterminate quantities exponential, circular, hyperbolic and inverse hyperbolic functions and their relations.

Unit – II

Differential Equations: Linear equations of second order with constant coefficients – Applications in electic circuit and deflection of beams – Simulations differential equations with variable coefficients – Euler's homogenous differential equations – Legender's differential equations reducible to Euler's homogenous equation.

Unit – II

Complete Solution in terms of an integral of corresponding homogenous equation obtained by inspection – Reduction to normal form by removing the first derivative change of independent variable – Variation of parameters.

Unit IV

Vector scalar and vector point function – Differentiation of vectors – Gradient of a scalar function – Simple application – Divergence and of Vector functions Solenoidal and irrotational fields – simple application – Laplacian operator – Expansion formulae of first and second order differential operators.

Unit – V

Vector Integration: Line Integral – surface integral – Volume Integral – Gauss divergence theorem – Strokes theorem – Greens theorem in plane (Proof of theorem not needed) – simple applications.

Text Books:

1. Dr. M.K. Venaktaraman, Engineering Mathematics (Series) National Publishing Co., Chennai-2005.
2. Dr. S. Arumugam & others, Engineering Maths series, Meenakshi Publications, Chennai., 2005.

References:

1. Marie C. Potter and Jack Goldberg, Mathematical methods, Prentice Hall of India New Delhi-1.

PMEEC102 ENGINEERING MECHANICS

OBJECTIVES

At the end of this course the student should be able to understand the kinematics and kinetics and both rectilinear and curvilinear motions, concept of work-energy and impulse momentum principles. He should be able to comprehend the loss of motion and able to write the equations of dynamic equilibrium. All these should be achieved both conceptually and through solved examples

UNIT- I

Kinematics of particle - Kinematics of Rectilinear motion - Motion of bodies with constant acceleration - Motion of bodies falling freely - Motion of bodies projected vertically upwards - Motion with variable acceleration - Composition of displacements, Resolution of velocities - Polygon law of velocities - Relative velocity - Kinematics of curvilinear motion - Motion of a particle in a plane - Motion of a projectile - Equation of the path - expression for time of flight, height, range and angle of projection - projection on an inclined plane - Motion along a circle.

UNIT- II

Kinetics of particle - Kinetics of rectilinear motion - D'Alembert's principle - Motion of lift - Motion over a smooth pulley - Motion of two masses connected by a string - Kinetics of curvilinear motion - centrifugal force - angular momentum - Rotation - Centroidal rotation - superelevation - Motion of a vehicle on a circular path - Maximum speed to avoid overturning and skidding.

UNIT- III

Moments of inertia - Area moments of inertia - Polar moment of inertia of an area - Product of inertia of an area - parallel axis theorem - composite area - Mass moments of inertia - Radius of gyration of axes.

UNIT- IV

Kinetics of particle - Work and energy - work done by a force - Relation between work and kinetic energy for rectilinear translation - Work done by a couple or torque - relation between work and kinetic energy for plane motion - Principle of conservation of energy - Power.

UNIT- V

Impulse and momentum - Relation between impulse and momentum for rectilinear translation - conservation of linear momentum - Angular impulse and angular momentum - Conservation of angular momentum - Collision of elastic bodies - impact - Direct and Oblique impact - Co-efficient of restitution - loss of kinetic energy during impact.

Text Books:

1. Sadhu Singh, Engineering Mechanics, Oxford & IBH Publishing Co.
2. Tayal A.K., Engineering Mechanics, Umesh Publication, New Delhi

Reference Books:

1. Mc Lean & Nelson, Engineering Mechanics, Schaum's series.
2. Irwing H.Shames, Engineering Mechanics, Prentice Hall of India, Delhi, 1996.
3. Khurmi R.S., Engineering Mechanics, S.Chand & Co., New Delhi.
4. Narayanan S, Dynamics, S.Chand & Co., New Delhi.

PMEEC205 ELECTRONICS

OBJECTIVES

To impart a sound understanding of the principles of electronics engineering with an emphasis on concepts and quantitative approach.

UNIT- I

Brief treatment of behaviour of P-N junction - characteristics and uses of semi- conductor diodes, photo diodes, Zener diodes, transistor, FET and UJT - Rectifier circuits - Half Wave, full wave, bridge - Filters - Zener voltage regulators.

UNIT- II

Classification and characteristics of transistorised amplifiers - voltage, current and power gain - Frequency response - Applications. Audio amplifiers - Principle of negative feedback -emitter follower. Power amplifiers - class A,B,C - applications.

UNIT- III

SCR - working - characteristics - speed control of D.C. shunt, 3 phase and single phase induction motor - voltage regulators - UPS. Operational amplifiers - characteristics of ideal and practical OP amps - application of OP amps - voltage and current followers.

UNIT- IV

Logic circuits - AND, OR, NOR, NAND, NOT, EX-OR operators - Flip Flops - Semiconductor memories - counter , Modulo, Decade.

UNIT- V

Introduction to IC technology - Monolithic Integrated circuits - SSI, MSI, LSI circuits (Qualitative treatment only) Basic architecture of a general Microprocessor - functions of different blocks - area of application.

Text Books:

1. Theraja, B.L: A Text Book of Electrical Technology - Vol. IV, S.Chand & Co, New Delhi.

Reference Books:

1. Mehta, V.K.: Principles of Electronics, S.Chand & Co., New Delhi.
2. Alan Mottersheal: Electronic Devices and Circuits, Prentice Hall of India.
3. Albert Malvino: Digital Computer Electronics, Tata McGraw-Hill.

PMEEC 305 PRODUCTION TECHNOLOGY

OBJECTIVES

To understand the concept and basic mechanics of metal cutting, deformation processes, metrology and machine tools.

To understand the basic concepts of numerical control (NC) machine tool and special purpose machines.

UNIT – I

Metal Cutting: Types of Cutting tools – Tool signature – tool angle and purpose – physical principle of metal cutting – Types of chips – Tool forces – Merchants circles – Measurement of forces.

UNIT – II

Bulk deformation processes such as rolling, extrusion and forging – Tools and dies used – machines and equipment used.

Press working: Classification of presses – Drive arrangement – Selection of presses – Feeding devices – Drawing, blanking piercing and sketch forming opertions.

UNIT – III

Metrology: Principles of interferometry – use of optical flat autocollimator and tool makers microscope in precision measurement – measurement of surface finish – Comparators for inspection – gear inspection.

Principle of air gauging – autosizing – slide position measuring devices.

UNIT – IV

Machine Tools: Principle of single spindle and multispindle automatics copying systems for timing.

N.C.Machines – Control system – Continuous path machining – point positioning – monitoring systems – Data preparation – introduction of machining centers – Transfer machines – Rotary indexing table transfer machines – Drum type transfer machine.

UNIT – V

Special manufacturing methods: Principles and mechanisms of electro discharge machining, electro chemical machining, chemical milling, ultrasonic machining, laser machining, explosive forming, electro, hydraulic forming and magnetic pulse forming.

References:

1. Haskehurs M, Manufacturing Technology, The English University Press Limited , London.

2. Wilson, High velocity forming of Metal

3. ASTME, Hand book of Industrial Metrology.

PMEEC 505 MECHANICAL ENGINEERING LABORATORY – I

The syllabi for the above laboratory will be suitably and appropriately framed by the Head of the Department from time to time depending on textual background, availability of machines and any future infrastructure development.

- - -

PMEEC 605 MECHANICAL ENGINEERING LABORATORY – II

The syllabi for the above laboratory will be suitably and appropriately framed by the Head of the Department from time to time depending on textual background, availability of machines and any future infrastructure development.

- - -