SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 119.

SYLLABUS

BACHELOR OF ENGINEERING PROGRAMME
IN
MECHANICAL ENGINEERING (8 SEMESTERS)
REGULATIONS 2010

SATHYABAMA UNIVERSITY
REGULATIONS – 2010

Effective from the academic year 2010-2011 and applicable to the students admitted to the Degree of Bachelor of Engineering / Technology. (Eight Semesters)

1. Structure of Programme

1.1 Every Programme will have a curriculum with syllabi consisting of theory and practical such as:

(i) General core courses comprising Mathematics, Basic Sciences, Engineering Sciences.

(ii) Core course of Engineering / Technology.

(iii) Elective course for specialization in related fields.

(iv) Workshop practice, Computer Practice, Engineering Graphics, Laboratory Work, Industrial Training, Seminar Presentation, Project Work, Educational Tours, Camps etc.

1.2 Each semester curriculum shall normally have a blend of lecture courses not exceeding 7 and practical courses not exceeding 4.

1.3 The medium of instruction, examinations and project report will be in English.

2. Duration of the Programme

A student is normally expected to complete the B.E/B.Tech. Programme in 8 semesters **but in any case not more than 12 consecutive semesters from the time of commencement of the course** (**not more than 10 semesters for those who join 3rd semester under Lateral entry system**) The Head of the Department shall ensure that every teacher imparts instruction as per the number of hours specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

3. Requirements for Completion of a Semester

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester.

3.1 He/She secures not less than 90% of overall attendance in that semester.

3.2 Candidates who do not have the requisite attendance for the semester will not be permitted to write the University Exams.

4. Examinations

The examinations shall normally be conducted between October and December during the odd semesters and between March and May in the even semesters. The maximum marks for each theory and practical course (including the project work and Viva Voce examination in the Eighth Semester) shall be 100 with the following breakup.

(i) **Theory Courses**

Internal Assessment : 20 Marks

University Exams : 80 Marks

(ii) **Practical Courses**

Internal Assessment : - -

University Exams : 100 Marks

5. Passing requirements

(i) A candidate who secures not less than 50% of total marks prescribed for the course (For all courses including Theory, Practicals and Project work) with a minimum of 35 marks out of 80 in the University Theory Examinations, shall be declared to have passed in the Examination.

(ii) If a candidate fails to secure a Pass in a particular course, it is mandatory that he/she shall reappear for the examination in that course during the next semester when examination is conducted in that course. However the Internal Assessment marks obtained by the candidate in the first attempt shall be retained and considered valid for all subsequent attempts.

6. Eligibility for the Award of Degree

A student shall be declared to be eligible for the award of the B.E/B.Tech. degree provided the student has successfully completed the course requirements and has passed all the prescribed examinations in all the 8 semesters within the maximum period specified in clause 2.

7. Award of Credits and Grades

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, Letter Grades will be awarded as per the range of total marks (out of 100) obtained by the candidate as given below:

RANGE OF MARKS FOR GRADES

Range of Marks	Grade	Grade Points (GP)
90-100	A++	10
80-89	A+	9
70-79	B++	8
60-69	B+	7
50-59	C	6
00-49	F	0
ABSENT	W	0

CUMULATIVE GRADE POINT AVERAGE CALCULATION

The CGPA calculation on a 10 scale basis is used to describe the overall performance of a student in all courses from first semester to the last semester. F and W grades will be excluded for calculating GPA and CGPA.

$$CGPA = \frac{\Sigma_i C_i GP_i}{\Sigma_i C_i}$$

where C_i - Credits for the subject

GP_i - Grade Point for the subject

Σ_i - Sum of all subjects successfully cleared during all the semesters

8. Classification of the Degree Awarded

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the semesters in **his/her first appearance** within a maximum period of 8 consecutive semesters after commencement of study (maximum of 6 semesters for Lateral entry system who join the course in the third semester) securing a **CGPA not less than 9.0** shall be declared to have passed the examination in **First Class – Exemplary.**

2. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the semesters in **his/her first appearance** within a maximum period of 8 consecutive semesters after commencement of study (maximum of 6 semesters for Lateral entry system who join the course in the third semester) securing a **CGPA not less than 7.5** shall be declared to have passed the examination in **First Class with Distinction.**

3. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the semesters within a maximum period of 8 consecutive semesters after commencement of study (maximum of 6 semesters for Lateral entry system who join the course in the third semester) securing a **CGPA not less than 6.0** shall be declared to have passed the examination in **First Class.**

4. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 12 consecutive semesters (10 consecutive semesters for Lateral Entry system who join the course in the third semester) after his/her commencement of study securing a **CGPA not less than 5.0** shall be declared to have passed the examination in **Second Class**.

5. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification of degree. **For all the above mentioned classification of Degree, the break of study during the programme, will be counted for the purpose of classification of degree.**

6. A candidate can apply for revaluation of his/her semester examination answer paper in a theory course, within 1 week from the declaration of results, on payment of a prescribed fee along with prescribed application to the Controller of Examinations through the Head of Department. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

Final Degree is awarded based on the following:

CGPA ≥ 9.0	**-**	**First Class - Exemplary**
CGPA ≥ 7.50 < 9.0	**-**	**First Class with Distinction**
CGPA ≥ 6.00 < 7.50	**-**	**First Class**
CGPA ≥ 5.00 < 6.00	**-**	**Second Class**

Minimum CGPA requirements for award of Degree is 5.0 CGPA.

9. Discipline

Every student is required to observe disciplined and decorous behaviour both inside and outside the University and not to indulge in any activity which will tend to bring down the prestige of the University. If a student indulges in malpractice in any of the University theory / practical examination, he/she shall be liable for punitive action as prescribed by the University from time to time.

10. Revision of Regulations and Curriculum

The University may revise, amend or change the regulations, scheme of examinations and syllabi from time to time, if found necessary.

B.E. - MECHANICAL ENGINEERING
REGULATIONS 2010 - CURRICULUM
SEMESTER I

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX1001	Engineering Mathematics – I	3	1	0	4	1
2	SCHX1001	Environmental Science & Engineering	3	0	0	3	2
3	SPHX1001	Physics of Materials	3	0	0	3	3
4	SCYX1001	Engineering Chemistry	3	0	0	3	4
5	SCSX1002	Programming In C	3	0	0	3	5
6	SMEX1002	Engineering Mechanics	2	1	0	3	6
7	SMEX1001	Engineering Graphics	1	2	0	3	7
PRACTICALS							
1	SPRX4002	CAD Lab – I	0	0	4	2	8
2	SCSX4002	Programming In C Lab	0	0	4	2	8
					TOTAL CREDITS	**26**	

SEMESTER II

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX1002	Engineering Mathematics – II	3	1	0	4	9
2	SHSX1001	English for Science & Technology	3	0	0	3	10
3	SPHX1002	Applied Physics	3	0	0	3	11
4	SCYX1003	Chemistry of Industrial Materials	3	0	0	3	12
5	SCSX1003	Programming in C++	3	0	0	3	13
6	SEEX1002	Basic Electrical & Electronics Engineering	2	1	0	3	14
7	SPRX1001	Basic Mechanical Engineering & Civil Engineering	3	0	0	3	15
PRACTICALS							
1	SPRX4001	Mechanical Workshop Lab	0	0	4	2	16
2	SCSX4007	Programming in C++ Lab	0	0	4	2	17
					TOTAL CREDITS	**26**	

L - Lecture hours; T - Tutorial hours; P - Practical hours; C - Credits

SEMESTER III

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX1009	Engineering Mathematics-III	3	1	0	4	18
2	SMEX1003	Kinematics of Machines	2	1	0	3	19
3	SMEX1004	Engineering Thermodynamics	2	1	0	3	20
4	SMEX1005	Fluid Mechanics and Machinery	2	1	0	3	21
5	SMEX1006	Material Technology	3	0	0	3	22
6	SEEX1004	Electrical Technology	2	1	0	3	23
7	SMEX1007	Machine Drawing	1	2	0	3	24
PRACTICALS							
1	SMEX4001	Fluid Mechanics Lab	0	0	2	1	25
2	SMEX4002	Metallurgy Lab	0	0	2	1	25
3	SEEX4001	Electrical Engineering Lab	0	0	4	2	25
		TOTAL CREDITS				**26**	

SEMESTER IV

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX1010	Engineering Mathematics- IV	3	1	0	4	26
2	SMEX1008	Dynamics of Machinery	3	1	0	4	27
3	SMEX1009	Thermal Engineering	3	1	0	4	28
4	SMEX1010	Strength of Materials	2	1	0	3	29
5	SPRX1042	Manufacturing Technology –I	3	0	0	3	30
6	SPRX1007	CAD / CAM	3	0	0	3	31
PRACTICALS							
1	SMEX4003	Fluid Machinery Lab	0	0	2	1	32
2	SMEX4004	Material Testing Lab	0	0	2	1	32
3	SPRX4008	Machine Shop Practice Lab -I	0	0	2	1	33
4	SPRX4009	CAD Lab-II	0	0	2	1	33
		TOTAL CREDITS				**25**	

SEMESTER V

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMTX 1011	Applied Numerical Methods	3	1	0	4	34
2	SECX1011	Microprocessor & Microcontroller	2	1	0	3	35
3	SMEX1014	Design of Machine Elements	2	1	0	3	36
4	SMEX1015	Gas Dynamics and Jet Propulsion	3	1	0	4	37
5	SPRX1043	Manufacturing Technology – II	2	1	0	3	38
6	SMEX1016	Power Plant Engineering	2	1	0	3	39
7	SPRX1044	Measurements & Metrology	2	1	0	3	40
PRACTICALS							
1	SECX4014	Electronics & Microprocessor Lab	0	0	4	2	41
2	SPRX4006	Metrology Lab	0	0	2	1	41
3	SPRX4015	Machine Shop Practice Lab – II (Special Machines)	0	0	2	1	41
			TOTAL CREDITS			**27**	

SEMESTER VI

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMEX1017	Resource Management Techniques	3	0	0	3	42
2	SMEX1018	Heat and Mass Transfer	3	1	0	4	43
3	SMEX1019	Design of Transmission Systems	3	1	0	4	44
4	SMEX1020	Mechatronics	3	0	0	3	45
5		Elective-I	3	0	0	3	
6		Elective-II	3	0	0	3	
PRACTICALS							
1	SMEX4009	Dynamics Lab	0	0	2	1	46
2	SMEX4010	Mechatronics Lab	0	0	2	1	46
3	SMEX4011	Thermal Engineering Lab - I	0	0	4	2	46
			TOTAL CREDITS			**24**	

SEMESTER VII

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMEX1021	Total Quality Management	3	0	0	3	47
2	SMEX1022	Fluid Power Systems	3	0	0	3	48
3	SAUX1025	Automobile Engineering	3	0	0	3	49
4	SPRX1045	Production Planning & Control	3	0	0	3	50
5		Elective-III	3	0	0	3	
6		Elective-IV	3	0	0	3	
PRACTICALS							
1	SMEX4012	Thermal Engineering Lab - II	0	0	2	1	51
2	SMEX4013	CAD Lab-III	0	0	2	1	51
					TOTAL CREDITS	**20**	

SEMESTER VIII

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SBAX1001	Principles of Management & Professional Ethics	3	0	0	3	52
2	SPRX1046	Modern Manufacturing Process	3	0	0	3	53
3	SMEX1023	Wind & Solar Energy	3	0	0	3	54
PRACTICALS							
1	SPRX4011	Design of Jigs & Fixtures and Press Tools Laboratory	0	0	2	1	55
2	SPRX4014	CAM Simulation Lab	0	0	2	1	56
3	S15XPROJ	Project Work and Viva Voce	0	0	30	15	56
					TOTAL CREDITS	**26**	

TOTAL CREDITS FOR THE COURSE 200

LIST OF ELECTIVE SUBJECTS

Note: ONE SUBJECT IS TO BE CHOSEN FROM EACH GROUP COMPULSORILY

Group I – THERMAL

Sl. No.	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SMEX1024	Advanced Internal Combustion Engineering	3	0	0	3	57
2	SMEX1025	Cryogenic Engineering	3	0	0	3	58
3	SMEX1026	Refrigeration and air conditioning	3	0	0	3	59
4	SMEX1027	Combustion Engineering	3	0	0	3	60
5	SMEX1031	Design of Heat Transfer Equipment	3	0	0	3	61
6	SMEX1034	Solid Waste Management	3	0	0	3	62

Group II – DESIGN

1	SMEX1032	Vibration and Noise Control	3	0	0	3	63
2	SMEX1033	Industrial Tribology	3	0	0	3	64
3	SMEX1036	Experimental stress analysis	3	0	0	3	65
4	SMEX1039	Finite Element Analysis	3	0	0	3	66
5	SMEX1038	Computational Fluid Dynamics	3	0	0	3	67

Group III – PRODUCTION

1	SMEX1029	Non Destructive Testing and Techniques	3	0	0	3	68
2	SMEX1037	Design for Manufacture	3	0	0	3	69
3	SMEX1040	Industrial Handling & Storage Systems	3	0	0	3	70
4	SMEX1041	Artificial Intelligence & Expert Systems	3	0	0	3	71
5	SPRX1019	Industrial Robotics and Expert Systems	3	0	0	3	72
6	SPRX1021	Powder Metallurgy	3	0	0	3	73
7	SPRX1022	Six Sigma Methods and Applications	3	0	0	3	74
8	SPRX1024	System Simulation & Modeling	3	0	0	3	75
9	SPRX1025	Supply Chain Management	3	0	0	3	76
10	SPRX1028	Non Traditional Machining Techniques	3	0	0	3	77
11	SPRX1029	Special Casting Processes	3	0	0	3	78

Group IV – ENERGY CONVERSION & MANAGEMENT SYSTEMS

1	SAUX 1016	Alternate Fuels And Energy Systems	3	0	0	3	79
2	SAUX 1023	Fuel Cell And Applications	3	0	0	3	80
3	SMEX1028	Cogeneration and Waste Heat Recovery Systems	3	0	0	3	81
4	SMEX1030	Bio Energy Conversion Technologies	3	0	0	3	82
5	SMEX1035	Energy Engineering and Management.	3	0	0	3	83

DUAL DEGREE IN COMPUTER SCIENCE

Provision for candidates from Non-IT Branches of B.E/B.Tech to undergo Dual Degree Programme leading to B.E in Computer Science.

A. **Duration and Curriculum**

Candidates selected for a Dual degree programme shall undergo additional courses pertaining to Computer Science. These courses constitute with additional Curriculum as per annexure and consist of both core course and electives. The additional courses are to be undergone concurrently from the 3rd semester of the B.E/B.Tech. (Non-IT) degree programme and extends for one more year beyond the fourth year of the regular B.E/B.Tech. (Non-IT) degree programme to which he/she was first admitted. The additional courses are to be offered from 3rd to 8th Semester after normal working hours so that the regular B.E/B.Tech. (NonIT) remains unaffected.

B. A candidate undergoing dual degree programme should satisfy minimum attendance requirements for the course of additional Curriculum for each semester, as stipulated for the regular B.E/B.Tech. Degree Programme.

C. For the courses of additional Curriculum, a candidate has to write the same examination that is held for the regular B.E. Computer Science.

D. The passing rules for the dual degree programme shall be same as that of the regular B.E/B.Tech. Degree programme.

E. A candidate shall be declared to be eligible for the additional degree of B.E. Computer Science provided that

(i) The candidate has qualified for the regular B.E. or B.Tech. Degree in the non-IT branch in which he/she was originally admitted.

(ii) The candidate has successfully completed all the courses prescribed in the additional Curriculum within a maximum period of 12 semesters from the date of first admission.

(iii) There is no disciplinary action pending against the student.

CURRICULUM

SUBJECTS FOR DUAL DEGREE PROGRAMME IN COMPUTER SCIENCE

THIRD SEMESTER

Sl.No.	SUBJECT CODE	NAME OF THE SUBJECT	L	T	P	C
THEORY						
1	SCSX1004	Software Engineering	3	0	0	3
2	SCSX1005	Data Structures & Algorithms	3	1	0	4
PRACTICALS						
3	SCSX4004	Data Structures Lab	0	0	4	2
			TOTAL CREDITS			**9**

FOURTH SEMESTER

THEORY						
1	SCSX1007	Java Programming	3	0	0	3
2	SCSX1009	Computer Architecture & Organization	3	0	0	3
PRACTICALS						
3	SCSX4005	Java Programming Lab	0	0	4	2
			TOTAL CREDITS			**8**

FIFTH SEMESTER

THEORY						
1	SCSX1017	Data Communication and Computer Networks	3	1	0	4
2	SCSX1018	Database Systems	3	1	0	4
PRACTICALS						
3	SCSX4011	RDBMS Lab	0	0	4	2
			TOTAL CREDITS			**10**

SIXTH SEMESTER

THEORY						
1	SCSX1019	System Programming	3	0	0	3
2	SCSX1022	J2EE	3	0	0	3
PRACTICALS						
3	SCSX4010	System Programming Lab	0	0	4	2
			TOTAL CREDITS			**8**

SEVENTH SEMESTER

THEORY						
1	SCSX1008	C# and .Net	0	0	0	3
2	SCSX1011	Operating System	3	1	0	4
PRACTICALS						
3	SCSX4006	C# and .Net Lab	0	0	4	2
			TOTAL CREDITS			**9**

EIGHTH SEMESTER

THEORY						
1	SCSX1024	Network Programming & Management	3	0	0	3
2		Elective I	3	0	0	3
3		Elective II	3	0	0	3
PRACTICALS						
4	SCSX4012	Network Programming Lab	0	0	4	2
			TOTAL CREDITS			**11**

NINETH SEMESTER

THEORY						
1	SCSX1023	Computer Graphics & Multimedia Systems	3	0	0	3
2	SCSX1030	Datamining & Warehousing	3	0	0	3
3	SCSX1025	Wireless & Mobile Networks	3	0	0	3
4	SCSX1027	Hardware Peripherals and Interfacing	3	0	0	3
5		Elective III	3	0	0	3
6		Elective IV	3	0	0	3
PRACTICALS						
7	SCSX4014	Hardware Peripherals Lab	0	0	4	2
8	SCSX4015	Case Tools & Testing Lab	0	0	4	2
			TOTAL CREDITS			**22**

TENTH SEMESTER

1	S11XPROJ	Project Work and Viva-Voce	0	0	30	15
			TOTAL CREDITS			**15**

TOTAL COURSE CREDITS : 92

ELECTIVES FOR DUAL DEGREE PROGRAMME IN COMPUTER SCIENCE

Sl.No.	SUBJECT CODE	NAME OF THE SUBJECT	L	T	P	C
1.	SCSX1020	Component Based Technology	3	0	0	3
2.	SCSX1026	Cryptography & Network Security	3	0	0	3
3.	SCSX1028	Distributed Computing	3	0	0	3
4.	SCSX1032	Management Information System	3	0	0	3
5.	SCSX1036	FOSS	3	0	0	3
6.	SCSX1038	Software Quality Assurance and Testing	3	0	0	3
7.	SCSX1039	Unified Modeling Language	3	0	0	3
8.	SCSX1042	Robotics	3	0	0	3
9.	SCSX1043	Unix Internals	3	0	0	3
10.	SCSX1044	Multicore Programming	3	0	0	3
11.	SCSX1047	High Performance Network	3	0	0	3
12.	SCSX1048	Grid Computing	3	0	0	3
13.	SCSX1049	Client Server Architecture	3	0	0	3
14.	SCSX1050	TCP/IP and Socket Programming	3	0	0	3
15.	SCSX1057	Cloud Computing	3	0	0	3

SMTX1001	ENGINEERING MATHEMATICS – I (Common to all branches except Bio Groups)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I TRIGONOMETRY 10 hrs.

Review of Complex numbers and De Moivre's Theorem. Expansions of $\sin n\theta$ and $\cos n\theta$; $\sin\theta$ and $\cos\theta$ in powers of θ, $\sin^n\theta$ and $\cos^n\theta$ in terms of multiples of θ. Hyperbolic functions – Inverse hyperbolic functions. Separation into real and imaginary parts of complex functions

UNIT II MATRICES 10 hrs.

Characteristic equation of a square matrix - Eigen values and Eigen vectors of a real matrix- properties of Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof) verification – Finding inverse and power of a matrix. Diagonalisation of a matrix using similarity transformation (concept only) , Orthogonal transformation – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT III GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS 10 hrs.

Curvature –centre, radius and circle of curvature in Cartesian co-ordinates only – Involutes and evolutes – envelope of family of curves with one and two parameters – properties of envelopes and evolutes – evolutes as envelope of normal.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 10 hrs.

Functions of two variables – partial derivatives – Euler's theorem and problems - Total differential – Taylor's expansion – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobian – Differentiation under integral sign.

UNIT V ORDINARY DIFFERENTIAL EQUATION 10 hrs.

Second order linear differential equation with constant coefficients – Particular Integrals for e^{ax}, sin ax, cos ax, x^n, $x^n e^{ax}$, e^{ax} sinbx, e^{ax} cos bx. Equations reducible to Linear equations with constant co-efficient using $x=e^t$. Simultaneous first order linear equations with constant coefficients - Method of Variations of Parameters.

TEXT / REFERENCE BOOKS:

1. Veerarajan. T , "Engineering Mathematics for First Year", Tata McGraw Hill Publishers ,II Edition ,2008.
2 Kandaswamy.P. & co., "Engineering Mathematics for First Year", S.Chand & Co Pub., IX revised edition, 2010.
3 Moorthy M.B.K, Senthilvadivu. K ,"Engineering Mathematics-I", VRB Pub., Revised Edition, 2010.
4. Arumugam. S & co. "Engineering Mathematics Vol-I", SciTech Pub., Revised Edition, 2010.
5. Venkataraman M.K.,"Engineering Mathematics – First Year" (2nd edition), National Publishing Co., 2000.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SCHX1001	ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to All Branches)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 12 hrs.

Definition, scope and importance - need for public awareness - forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, floods, drought, conflicts over water, dams-benefits and problems - mineral resources: use effects on forests and tribal people - water resources: use and over-utilization of surface and ground water - exploitation, environmental effects of extracting and using mineral resources, case studies - food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies - land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification - role of an individual in conservation of natural resources - equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS AND BIODIVERSITY 12 hrs.

Concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - introduction to biodiversity - definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - biodiversity at global, national and local levels - India as a mega-diversity nation - hot-spots of biodiversity - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT III ENVIRONMENTAL POLLUTION 10 hrs.

Definition - causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - solid waste management: causes, effects and control measures of urban and industrial wastes - role of an individual in prevention of pollution - pollution case studies - disaster management: floods, earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8 hrs.

From unsustainable to sustainable development - urban problems related to energy - water conservation, rain water harvesting, watershed management - resettlement and rehabilitation of people; its problems and concerns, case studies - environmental ethics: issues and possible solutions - climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. - wasteland reclamation - consumerism and waste products - environment protection act - air (prevention and control of pollution) act - water (prevention and control of pollution) act - wildlife protection act - forest conservation act - issues involved in enforcement of environmental legislation - public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 8 hrs.

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS - women and child welfare - role of information technology in environment and human health - case studies.

Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain. Visit to a local polluted site-urban/rural/ industrial/agricultural-study of common plants, insects, birds-study of simple ecosystems-pond, river, hill slopes etc.

TEXTBOOK / REFERENCE BOOKS:

1. Meenakshi.P, Elements of Environmental Science and Engineering, 1st edition, PHI New Delhi, 2009.
2. Ravikrishnan. A, Environmental Science & Engineering, 3rdedition, Sri Krishna Publications, Chennai, 2009.
3. Wrigh.R.T & Nebel B.J, Environmental science-towards a sustainable future by Richard 8th edition, prentice hall of India, Newdelhi, 2008.
4. Erach Bharucha ,Text Book of Environmental Studies, University Press, Chennai, 2008.
5. Anjanayelu.Y, Introduction to Environmental Engineering, B.S.Publications, 2008.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80 Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPHX1001	PHYSICS OF MATERIALS (Common to all Branches of B.E / B.Tech)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CONDUCTING AND SUPERCONDUCTING MATERIALS 10 hrs.

Classical Free electron theory of Metals-Derivation of Electrical and Thermal Conductivity- Deduction of Wiedemann Franz law-Lorentz number. Introduction to Band theory, Difference between Conductors, Semiconductors and Insulators - Superconductivity-Transition temperature - occurrence of superconductivity - BCS Theory(Qualitative), properties of superconductors -Type I &Type II superconductors, High Tc superconductors, AC & DC Josephson effects. Applications of superconductors – basic concepts of SQUID, cryotron, magnetic levitation.

UNIT II MAGNETIC AND DIELECTRIC MATERIALS 10 hrs.

Types based on spin. Hard and soft magnetic materials, domain theory of Ferromagnetism, magnetic bubbles, formation and propagation of magnetic bubbles, applications of magnetic materials - Magnetic storage devices. Dielectric parameters, polarization, polarisability, types of polarization. Internal or local electric field - derivation of Lorentz Equation and Clausius - Mossotti Equation, dielectric loss and breakdown, types of dielectric breakdown, types of dielectric materials, applications.

UNIT III OPTICAL MATERIALS 10 hrs.

Optical processes and Excitons - types, Traps - Trapping and recombination, types, Point defects –Frenkel and Schottky defects - Colour centers - types and their mechanisms, Luminescence - Photoluminescence - Types-Fluorescence and Phosphorescence- Mechanism and its applications, Cathodoluminescence, Electroluminescence. Non-linear Optical Materials – Basic Principle, Classifications, Properties - Frequency Doubling or Tripling, Optical Mixing - Applications.

UNIT IV MODERN ENGINEERING MATERIALS 10 hrs.

Metals and alloys – steel and its properties - Iron-carbon phase diagram, Titanium and Aluminium based alloys - Introduction, properties and Applications. Shape Memory Alloys (SMA) - Principle of shape memory effects, Hysteresis curve, Two way shape memory alloys, super-elasticity and thermo-mechanical behavior. Characterization methods to identify the phase transformation of SMA, commercial SMA – Ni-Ti alloys, copper alloys and Cu-Al alloys, Applications. Ceramics – Classification, Properties, fabrication, advanced ceramics and applications. Composites – particle reinforced composites and fiber reinforced composites – processing and applications.

UNIT V CHARACTERIZATION OF MATERIALS 10 hrs.

Structural characterization – X-ray diffraction, electron diffraction and neutron diffraction – Determination of crystal structure. Difference among these diffraction techniques.Micro structural characterization – optical microscope, scanning electron microscope, transmission electron microscope, atomic force microscopy, micro and nano hardness testing – principle and applications.

REFERENCE BOOKS :

1. Ragavan.V, Material science and Engineerimg, 5th Edition, Eastern Eco, 2004.
2. Suresh.R and Jayakumar.V, Materials Science, 1st Edition, Lakshmi Publication, 2003.
3. Wilson.J and Hawkes.J.F.B, Optoelectronics- An Introduction, 2nd Edition, Prentice-Hall of India, 2001.
4. Dr.Arumugam M., Semiconductor Physics and Opto electronics, 1st Edition, Anuradha Publishers, 2003.
5. Gaur.R.K and Gupta.S.L, Engineering Physics, 8th Edition, Dhanbat Rai Publications,2007.
6. Palanisamy.P.K, Engineering Physics, 1st Edition, SCITECH Publications, 2007.
7. Sankar.B.N and Pillai.S.O, A text book of Engineering Physics, 1st Edition, New Age international Publishers, 2007.
8. Rajendran.V, Engineering Physics, 2nd Edition, Tata McGraw-Hill, 2008.
9. Avadhanulu.M.N and P.G. Kshirsagar.P.G, Engineering Physics, 2nd Edition, S. Chand & Company, 2007.
10. Dr. Arumugam M., Engineering Physics, 2nd Edition, Anuradha Publications, 2002.
11. William D.Callister,Jr, Materials Science and Engineering An introduction, 6th Edition, John-Wiley and Sons,2004.
12. Cullity.B.D, Principles of X-ray diffraction, 3rd Edition, Prentice Hall, 2001

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80 Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

Out of 20 marks, maximum of 10% problems may be asked. 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

Out of 60 marks, maximum of 10% problems may be asked 60 marks

'Applications' mentioned in the syllabus refer to the basic applications and not to any specific case.

SCYX1001	ENGINEERING CHEMISTRY (Common to All Branches)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I WATER TECHNOLOGY **10 hrs.**

Introduction: Impurities present in water, Hardness: Types of hardness, Expression, Units. Estimation of hardness by EDTA method, Problems. Boiler Troubles: Sludge & Scales, Boiler Corrosion. Water Softening: Zeolite process, Demineralization process, Merits and Demerits. Reverse osmosis, Merits and Demerits. Domestic water treatment: Flow chart diagram only.

UNIT II BATTERIES AND FUEL CELLS **10 hrs.**

Introduction - Battery terminology: Primary cells, Secondary batteries, Charging and Discharging characteristics, Capacity, Energy density, Cycle life, Internal resistance. Secondary batteries: Lead-acid accumulator, Nickel-cadmium batteries , Lithium primary cells: Lithium-thionyl chloride cell, Lithium-iodine cell. Lithium secondary batteries: Lithium-ion batteries. Fuel cells: Hydrogen-Oxygen fuel cell, Solid oxide fuel cell (SOFC): Principle, construction, anode cathode and electrolyte. Proton Exchange Membrane Fuel Cell.

UNIT III CORROSION SCIENCE **10 hrs.**

Introduction - Electrochemical cell representation. Electrochemical series: Significance. Galvanic series.

Corrosion: Definition of corrosion, Dry corrosion: Mechanism of Dry corrosion, Pilling-Bedworth rule, Wet Corrosion: Mechanism. Types of corrosion: Galvanic corrosion, Differential aeration corrosion, Pitting corrosion, Microbial Corrosion. Factors influencing corrosion: Nature of the metal, nature of the environment. Corrosion control: Material selection and Design, Cathodic protection. Corrosion inhibitors: Anodic, cathodic and Vapour phase inhibitors.

UNIT IV EXPLOSIVES AND ROCKET PROPELLANTS **10 hrs.**

Introduction - Explosives: Requirements, Classification of Explosives: Low explosives, primary explosives and high explosives. Assessment of explosives.

Rocket engines: Types of rocket engines. Basic principle, Mass fraction, Specific impulse, Thrust, Effective exhaust velocity, Specific propellant consumption. Chemical propellants: Requirements, Classification: Liquid fuels, Liquid oxidizers, Solid fuels, Solid oxidizers.

UNIT V SURFACE CHEMISTRY **10 hrs.**

Introduction. Adsorption: Types, Adsorption of gases on solids, Adsorption of solutes from solution. Adsorption isotherms: Freundlich adsorption isotherm, Langmuir adsorption isotherm. Industrial adsorbent materials: Role of adsorbents in catalysis and water softening. Emulsion: Types: water/oil, oil/water. Applications of adsorption: Cottrell's precipitator, Coating of rubber on metals, Electrostatic painting.

TEXT / REFERENCE BOOKS:

1. Jain P.C. and Monica Jain,Engineering Chemistry, 15th Edition Dhanpat Rai Publishing Co. 2009
2. Dara S.S., Text Book of Engineering Chemistry, S.Chand & Co, 2008
3. Sheik Mideen A., Engineering Chemistry (I & II),13th Edition, Shruthi Publishers, 2010
4. Parameswara Murthy C, Agarwal C V, Andra Naidu, Textbook of Engineering Chemistry, B S Publications, 2006
5. Kuriakose J.C. and Rajaram J., Chemistry in Engineering and Technology",. Vol.1 & 2, 5th reprint, Tata McGraw Hill Publishing Company (P) Ltd., 2010.
6. Sharma B.K., Engineering Chemistry, 2nd Edition, Krishna Prakasam Media (P) Ltd., 2001
7. Puri Br, Sharma Lr, Madhan S Pathania, Principles of Physical Chemistry, 41st Edition, Vishal Publishing Co., 2004
8. Mars G Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw Hill, 2008
9. David Linden, Thomas B Reddy, Handbook of Batteries, 4th Edition, McGraw-Hill, 2010
10. George Paul Sutton, Oscar Biblarz, Rocket Propulsion Elements, 8th Edition, John Wiley & Sons, 2010

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

One problem for 5 marks may be asked in Unit 1 - Water Technology 60 marks

SCSX1002	PROGRAMMING IN C (Common to all Branches of B.E / B.Tech.)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Introduction: Algorithms & flowcharts-Overview of C-Features of C-IDE of C Structure of C program-Compilation & execution of C program-Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, local and global variables. Operators: arithmetic, logical, relational, conditional and bitwise operators- Special operators: size of () & comma (,) operator-Precedence and associativity of operators & Type conversion in expressions.

Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche() & putchar()-Formatted input/output: printf() and scanf()-Library Functions: concepts, mathematical and character functions.

UNIT II CONTROL STRUCTURES AND FUNCTIONS **10 hrs.**

Control structures: Conditional control-Loop control and Unconditional control structures.

Functions: The Need of a function-User defined and library function- Prototype of a function-Calling of a function-Function argument-Passing arguments to function- Return values-Nesting of function- main()-Command line arguments and recursion. Storage class specifier – auto, extern, static, & register.

UNIT III ARRAYS AND STRUCTURE **10 hrs.**

Arrays: Single and multidimensional arrays-Array declaration and initialization of arrays-Array as function arguments.

Strings: Declaration-Initialization and string handling functions.

Structure and Union: Defining structure-Declaration of structure variable-Accessing structure members-Nested structures-Array of structures-Structure assignment-Structure as function argument-Function that returns structure- Union.

UNIT IV POINTERS **10 hrs.**

Pointers: The '&' and '* ' operators-Pointers expressions-Pointers vs arrays-Pointer to functions-Function returning pointers-Static and dynamic memory allocation in C.

DMA functions: malloc(), calloc(), sizeof(), free() and realloc()-Preprocessor directives.

UNIT V FILE MANAGEMENT AND GRAPHICS **10 hrs.**

File management: Defining, opening & closing a file, text file and binary file- Functions for file handling: fopen, fclose, gets, puts,fprint, fscanf, getw, putw, fputs, fgets, fread, fwrite-Random access to files: fseek, ftell, rewind-File name as Command Line Argument.

Graphics in PC-Initialize Graphics Mode-Functions used In Graphics - Drawing a Point on the Screen-Drawing lines, rectangles, ovals, circles, arcs, polygon, filling colors-Using Text in Graphics Display.

REFERENCE BOOKS:

1. Balaguruswami.E, 'Programming in C', TMH Publications,1997
2. Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science A Structured Programming using C", Cengage Learning, 3rd Edition, 2007
3. Gottfried , 'Programming with C', schaums outline series, TMH publications,1997
4. Mahapatra , 'Thinking in C', PHI publications, 2nd Edition, 2008.
5. Stevens , 'Graphics programming in C', BPB publication, 2006
6. Subbura.R , 'Programming in C', Vikas publishing, 1st Edition, 2000

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1002	ENGINEERING MECHANICS (Common to Mech, Mech & Prod, Aero, Auto and Civil)	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I BASICS & STATICS OF PARTICLES **10 hrs.**

Introduction - Units and Dimensions - Laws of Mechanics - Vectors - Vectorial representation of forces and moments - Vector operations, Coplanar forces resolution and composition of forces - equilibrium of a particle - forces in space - equilibrium of a particle in space - equivalent systems of forces - principle of transmissibility - Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES **10 hrs.**

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS **10 hrs.**

Determination of Areas - First moment of Area and the centroid - simple problems involving composite figures.

Second moment of plane area - Parallel axis theorems and perpendicular axis theorems - Polar moment of Inertia - Principal moments of Inertia of plane areas - Principle axes of inertia - relation to area moments of Inertia. Second moment of plane area of sections like C,I,T,Z etc. - Basic Concept of Mass moment of Inertia

UNIT IV FRICTION **10 hrs.**

Frictional Force - Laws of Coulomb friction - Cone of friction- Angle of repose- Simple contact friction - Screw - Wedge - Ladder - Rolling resistance - Belt friction.

UNIT V DYNAMICS OF PARTICLES **10 hrs.**

Displacement, Velocity and acceleration their relationship - Relative motion - Curvilinear motion - Newton's Law -D'Alembert's Principle, Work Energy Equation - Impulse and Momentum - Impact of elastic bodies.

Translation and rotation of rigid bodies- General plane motion.

TEXT BOOKS / REFERENCE BOOKS:

1. Beer & Johnston,"Vector Mechanics for engineers - Vol I &II", 8th Edition,2005
2. Irving H Shames, "Engineering Mechanics - Statics and Dynamics" 3rd edition, Prentice Hall of India pvt ltd 1993.
3. Timoshanko and Young, "Engineering Mechanics",4th Edition, Tata McGrawhill 2005.
4. McLean, "Engineering Mechanics" 3rd Edition, Schaum Series 1995
5. Ramachandran S., "Engineering Mechanics" 4th Edition, Air Walk Publications, 2006

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

80% Problems and 20% Theory Questions may be asked

SMEX1001	ENGINEERING GRAPHICS (Common to all Branches of B.E / B.Tech)	L	T	P	Credits	Total Marks
		1	2	0	3	100

UNIT I CONSTRUCTION OF PLANE CURVES **10 hrs.**

Introduction - Importance of graphics in engineering applications – Use of drafting instruments – BIS specifications and conventions – Size, layout and folding of drawing sheets – Lettering and dimensioning- Polygons used in engineering practice– methods of construction of pentagon and hexagon– Construction of ellipse, parabola and hyperbola.

UNIT II PROJECTION OF POINTS AND LINES **10 hrs.**

General principles of orthographic projection – first angle projection – layout of views – projections of points, straight lines located in the first quadrant – Determination of true lengths of lines and their inclinations to the planes of projection – Traces

UNIT III PROJECTION OF SOLIDS AND SECTION OF SOLIDS **10 hrs.**

Projection of solids like prism, pyramid, cylinder and cone when the axis is inclined to only one plane of projection – Change of position method only - Sectioning of above mentioned solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other – True shapes of sections

UNIT IV DEVELOPMENT OF SURFACES AND FREE HAND SKETCHING **10 hrs.**

Need for development of surfaces – Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.- Pictorial representation of engineering objects – Representation of three dimensional objects in two dimensional media – Need for multiple views – Developing visualization skills through free hand sketching of three dimensional objects.

UNIT V ISOMETRIC PROJECTIONS & PERSPECTIVE PROJECTIONS **10 hrs.**

Principles of isometric projection – Isometric scale – Isometric projections of simple solids and combination of solids - Prisms, pyramids, cylinders, cones and spheres (excluding isometric projections of truncated solids) - Perspective projections - Simple objects like – cube, prisms, pyramids by Vanishing point method & Visual Ray method (excluding perspective projections of truncated solids)

TEXT BOOKS / REFERENCE BOOKS:

1. Natarajan, K.V, " A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006 .
2. Venugopal, K. and Prabhu Raja, V., "Engineering Graphics", New Age International(P) Ltd.,2008.
3. Ramachandran. S, Pandian. K, Ramanamurthy. E.V.V. and Devaraj. R "Engineering Graphics", AirWalk Publications, Chennai, 2009
4. IS 10711-2001: Technical Products Documentation – Size and Layout of Drawing Sheets
5. IS 9609 (Parts 0 & 1)-2001: Technical Products Documentation – Lettering
6. IS 10714(Part 20)-2001 & SP 46 -2003: Lines for Technical Drawings
7. IS 11669-1986 & SP 46-2003: Dimensioning of Technical Drawings
8. IS 15021(Parts 1 to 4)-2001: Technical Drawings-Projection Methods

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

Part A: equal distribution of questions from each unit.

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

Part B - Split up:

Unit 1: 1 question from construction of hexagon / pentagon / ellipse &
1 question from construction of parabola / hyperbola

Unit 2: 1 question from projection of points & 1 question from projection of lines inclined to both the planes.

Unit 3: 1 question from projection of solids & 1 question from section of solids.

Unit 4: 1 question from development of surfaces & 1 question from orthographic projection.

Unit 5: 1 question from isometric projection & 1 question from perspective projection.

SPRX4002	CAD LAB-I	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Introduction

Basics, Fundamentals of feature based modeling.

2. Two Dimensional objects:

Create basic drawing objects - Points, Lines, Circles / Arcs, Planes and their combination,

Setup a drawing with correct scales, Draw with precision using Coordinate input & object

Snaps. Isometric drawing, Orthographic projection, Auxiliary views,

Modify with edit commands, Dimension and add text to drawing, Plot drawings

3. Three Dimensional objects:

Creating and Editing 3D objects, Viewing in 3D

4. Drawing creation from 3D models: Creation of various views and dimensioning,

Dimensioning commands, Editing Dimensions and Dimension text, Creating and Saving

Dimension styles, Updating Dimensions, specification of tolerances and surface finish, annotations, symbols like welding, fillet, threads.

SCSX4002	PROGRAMMING IN C LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. To write a simple menu driven calculator program using switch statement.
2. To write a program to calculate the nCr using functions.
3. To write a program to find the largest and smallest number using arrays.
4. To write a program to generate Fibonacci series.
5. To write a program to find the factorial of a number using recursion.
6. To write a program to print the sum of elements of an array using pointers.
7. To write a program to implement file handling
8. To write a program to perform matrix addition and multiplication.
9. To write a program to check for perfect number.
10. To write a program to implement string manipulation functions without using library functions.
11. To write a program to perform ASCII equivalent keystrokes.
12. To write a program to solve a polynomial equation.

SMTX1002	ENGINEERING MATHEMATICS II (Common to all branches Except BIO Groups)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I THEORY OF EQUATIONS 10 hrs.

Relation between roots and Co-efficient of equations – Symmetry function of roots – Formation of equations – To increase or decrease the roots of a given equation by a given quantity – Reciprocal equations – Descartes rule of signs – Cardon's method of solving cubic equations.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 10 hrs.

Direction cosines and ratios – The equation of a plane – Equation to a straight line – Shortest distance between two skew lines –Coplanar lines – Sphere – Tangent line – Plane section of a sphere – Orthogonal spheres.

UNIT III INTEGRAL CALCULUS 10 hrs.

Double integrals – Change of order of integration – Change of Variables from Cartesian to Polar coordinates – Area - using double integral - Triple integrals - Volume using Triple integrals.

UNIT IV BETA AND GAMMA FUNCTIONS 10 hrs.

Properties of definite Integrals – Related definite Integrals – Reduction formulae for e^{ax}, x^n sinax, x^n cos ax, $\sin^n x$, $\cos^n x$ and $\sin^m x \cos^n x$. Definitions of Beta and Gamma integrals – Relation between them – Properties – Evaluation of definite integrals in terms of Beta and Gamma function – Simple applications.

UNIT V VECTOR CALCULUS 10 hrs.

Differentiation of a vector function – Gradient, divergence and curl – Directional derivative – Identities (without proof) - Irrotational and Solenoidal fields, Vector Integration – Line, Surface and Volume Integrals, Integral theorems (without proof), Green's theorem (in the plane), Gauss divergence theorem and Stoke's theorem – Simple applications involving rectangles and cuboids.

TEXT / REFERENCE BOOKS:

1. Veerarajan.T, "Engineering Mathematics for First Year", 2nd Edition , Tata McGrawHill Publications ,2008
2. Kandaswamy. P & co., "Engineering Mathematics for First Year", 9th revised Edition, S.Chand & Co Pub., 2010
3. Arumugam.S & co, "Engineering Mathematics Vol-II", Revised Edition, SciTech Pub., 2010
4. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, 2007
5. Chandrika Prasad, "Text book on Algebra and theory of equations", Pothishala Private Ltd., Allahabad, 2009

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SHSX1001	ENGLISH FOR SCIENCE AND TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I **10 hrs.**

Reading comprehension- Skimming and Scanning - Transcoding -Bar diagram, Tables and Pie chart –Discussing topics of general interest or on current topics and making a presentation in the class - Conjunctions and discourse markers- cloze reading- affixes – definitions- tense- voice – jumbled sentences.

UNIT II **10 hrs.**

Subject verb agreement - Idioms and phrases, reading passages to answer evaluative, inferential and hypothetical type of questions- Listening - Creative thinking and speaking- Formal letters - application for job- resume preparation- inviting dignitaries to department workshops, symposium and university functions - Letter to the editor.

UNIT III **10 hrs.**

Reading and summarising reports - Writing a project proposal - Editing - Checking punctuation and grammatical errors- Types of Sentences – preparation of Check List- formulating questions and answers - communicating politely.

UNIT IV **10 hrs.**

Reported speech- Parts of speech- confusable words - Report on industrial visit - project report - Making effective Power Point presentations - speaking about the future plans-expressing opinions-reading and guessing meanings of unknown words from the context – using appropriate verb forms

UNIT V **10 hrs.**

Modal auxiliaries – Presentation of problems and solutions – wh- questions- question tags- punctuation- hyponymy- listening and taking notes – study skills – preparing notes

TEXT / REFERENCE BOOKS:

1. Aeda Abidi & Ritu Chowdary, “English For Engineers Made Easy”, Cengage India Learning Limited, New Delhi. 2010
2. Geetha Nagaraj, “A Course In Grammar and Composition”, Foundation Books Pvt. Ltd., New Delhi, 2006.
3. Hewings. M, “Advanced English Grammar”, Cambridge University Press, Chennai. 2000.
4. Nagini, P S et al, “Excellence Through communication”, Shri Jai Publications, Chennai, 2005.
5. Raman M & Sangeetha Sharma, “Technical Communication”, Oxford University Press, USA 2005.
6. Reddy Devika and Chowdhary S, “Technical English”, Mac Millan, Chennai. 2009
7. Rizvi, M.A., “Effective Technical Communication”, Tata McGRaw Hill Publishing Company Limited, New Delhi, 2006.
8. Verma. Shivendra K, “Interactive Grammar of Modern English”, Frank Brothers & Company, India, 2000.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A: 10 Questions of 2 marks each – no choice 20 marks

PART B: 6 Questions from the five units with internal choice, each carrying 10 marks 60 marks

SPHX1002	APPLIED PHYSICS (Common For All Branches)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I FIBER OPTICS **10 hrs.**

Introduction - Principle and structure of optical fibers-Acceptance angle-Numerical aperture-Types of optical fibers-Preparation of fiber – Double crucible technique-Types of rays-Theory of propagation of light-Energy loss in optical fiber- Attenuation and distortion-Fiber splicing – Fusion and mechanical splicing-Fiber connectors -Butt joint and expanded beam connectors-Optical fiber communication system (block diagram) - Advantages and its applications.

UNIT II ACOUSTICS OF BUILDINGS **10 hrs.**

Introduction – Musical sound & noise-Characteristics of musical sound : pitch, loudness, quality – Weber-Fechner law-Relation between pitch & frequency-Factors on which intensity & loudness depend-Decibel scale-Sound intensity level and sound pressure level-Sound absorption-OWU-Sound absorption coefficient and its measurements – Reverberation - Reverberation time – Standard Reverberation time – Sabine's formula to determine the Reverberation time (Jaegar method)- Factors affecting the acoustics of a building and the remedies-Principles to be followed in the acoustical design of a good auditorium.

UNIT III FUNDAMENTALS OF DIGITAL ELECTRONICS **10 hrs.**

Number systems - Binary, decimal, Hexadecimal and Octadecimal-Conversion from one number system to another-Binary addition-Subtraction - Subtraction by 1's & 2's complement- BCD-ASCII-Excess 3 code and gray code.

UNIT IV NANO DEVICES **10 hrs.**

Definition-Fabrication-Top down approach and bottom up approach-Nanomagnets – Particulate Nanomagnets, Geometrical Nanomagnets-Magneto Resistance – Ordinary Magneto Resistance, Giant Magneto Resistance, Tunneling Magneto Resistance- Probing Nanomagnetic Materials-Nanomagnetism in Technology-Nano Devices – Injection Laser – Quantum Cascade Laser – Optical Memories and Coulomb Blockade Devices

UNIT V MEDICAL PHYSICS **10 hrs.**

Ultrasonics –Introduction- Production of ultrasonic waves - Piezo-electric method-properties-Doppler effect - Blood flow meter – Determination of upward and downward transit time- A- scan, B-scan and M-scan-X-rays – Introduction-Units of X-rays- Diagnostic technologies of X-rays – Radiography-Fluoroscopy-Image intensifier-Nuclear medicine – Introduction-units of radioactivity, $^{99}_{m}Tc$ generator, nuclear medicine imaging devices - Gamma camera.

REFERENCE BOOKS :

1. Mathur.D.S, Heat and Thermodynamics, 5th Edition, Sultan Chand & Sons, 2004.
2. Gerd Keiser, Optical fiber communication, 3rd Edition, Tata Mc Graw Hill, 2000.
3. John M. Senior, Optical fiber communications - Principle and Practice, 2nd Edition, Pearson Education, 2006.
4. Franz J.H, Jain V.K, Optical communication – Components and Systems,1st Edition, Narosa Publications, 2001.
5. Malvino,Leach & Gautam Saha, Digital Principles and applications, 6th Edition, McGraw Hill, 2006.
6. William H. Gothman, Digital electronics – An int. to theory and practice,2nd Edition, PHL of India, 2007.
7. Roy, Medical Bio Physics, 1st Edition, Saras Publications, 2001.
8. Vasantha Pattabhi, Bio Physics, 1st Edition, Narosa, 2004.
9. Gaur. R.K. and Gupta. S.L., Engineering Physics, 8th edition, Dhanbat Rai Publications,2007.
10. Avadhanulu. M.N. and. Kshirsagar. P.G, Engineering Physics, 2nd edition, S. Chand & Company, 2007.
11. Dr. Arumugam M., Engineering Physics, 2nd edition, Anuradha Publications, 2002.
12. William D.Callister, Jr, Materials Science and Engineering An introduction, 6th Edition, John-Wiley and Sons, 2004.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80 Exam Duration: 3 hrs.

Part A: 10 Questions of 2 marks each – no choice 20 marks

Out of 20 marks, maximum of 10% problems may be asked

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

Out of 60 marks, maximum of 10% problems may be asked

'Applications' mentioned in the syllabus refer to the basic applications and not to any specific case

SCYX1003	CHEMISTRY OF INDUSTRIAL MATERIALS (Common to Mech, Mech & Prod, Chemical, Civil, Auto and Aero)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I FUELS **10 hrs.**

Introduction - Classification. Calorific values: GCV, NCV. Determination of calorific value by Bomb Calorimeter. Liquid Fuels: Petroleum, Refining of petroleum. Cracking: Fluidized bed catalytic cracking. Knocking in Internal Combustion engines , Cetane number, Octane number, Antiknocking agents: MTBE, ETBE. Gaseous Fuels: Natural gas, CNG. Flue gas analysis using Orsat's apparatus. Calculation of minimum quantity of air for combustion of fuels (simple problems)

UNIT II LUBRICANTS AND ADHESIVES **10 hrs.**

Lubricants: Introduction. Lubrication mechanism: Hydrodynamic lubrication, Boundary lubrication, Extreme pressure lubrication. Properties of lubricants: Viscosity index (VI), Flash and Fire point, Cloud and Pour point, Aniline point, Oiliness, Sligh oxidation test. Classification of lubricants: Liquid lubricants, Compounding of oil. Semi solid lubricants: Greases, Types of greases. Solid lubricants: Graphite and Molybdenum disulphide (MoS_2).

Adhesives: Classification: Natural and synthetic adhesives. Adhesive action. Development of bond strength. Physical and chemical factors influencing adhesive action.

UNIT III PHASE RULE **10 hrs.**

Introduction - Statement, Definition of terms involved with examples. Applications of phase rule to one component system: Water system. Reduced Phase rule: Construction of simple eutectic phase diagram using Thermal analysis, Lead silver system, Iron carbon system: Allotropes of Iron, Micro constituents of Fe-C phase diagram.

UNIT IV ALLOYS AND COMPOSITES **10 hrs.**

Alloys: Definition, Purpose of making alloys, Effect of alloying elements, Ferrous alloys: Stainless Steel. Non Ferrous alloys: Aluminium and Copper alloys.

Composites: Definition , Constituents: Matrix Phase and Dispersed phase. Types of Composites: Metal matrix composites (MMC), Ceramic matrix composites (CMC), Polymer matrix composites (PMC), Fiber reinforced plastics (FRP), Cermets.

UNIT V INTRODUCTION TO NANOMATERIALS **10 hrs.**

Introduction - Nanomaterials: definition, Nanoparticles: Synthesis by Chemical reduction method. Nanoporous materials: Synthesis by Sol-gel method. Nanowires: Synthesis by VLS mechanism. Carbon Nanotubes: Singlewalled and multiwalled nanotubes, Mechanical and electrical properties, Applications. Synthesis of Carbon Nanotubes: Electric arc discharge method, Physical Vapour Deposition (PVD), Chemical Vapour Deposition (CVD), Laser Ablation method.

TEXT / REFERENCE BOOKS:

1. Jain.P.C and Monica Jain,"Engineering Chemistry", 15th Edition, Dhanpat Rai Publishing Co., 2009.
2. Charles P.Poole Jr, and Frank J Owens, "Introduction to Nanotechnology", John Wiley and Sons, 2006.
3. Sheik Mideen.A, "Engineering Chemistry (I & II)", 13th Edition, Shruthi Publishers, 2010.
4. Dara.S.S, "Text Book of Engineering Chemistry", Reprint, S.Chand & Co, 2009.
5. Kuriakose.J.C and Rajaram.J, "Chemistry in Engineering and Technology",. Vol.1 & 2, 5th Rreprint, Tata McGraw Hill Publishing Company (P) Ltd., 2009.
6. Puri Br, Sharma Lr, Madhan S Pathania, "Principles of Physical Chemistry", 41st Edition, Vishal Publishing Co., 2004.
7. Uppal.M.M, "Engineering Chemistry", 6th Ed, Khanna Publ., 2006.
8. Aggrawal.O.P, "Engineering Chemistry", 3rd Ed, Khanna Publ., 2003.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SCSX1003	PROGRAMMING IN C++ (Common to all Branches)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO C++ 10 hrs.

Object Oriented Programming Paradigms - Comparison of Programming Paradigms – Object Oriented Languages - Benefits of Object Oriented Programming - Comparison with C - Overview of C++ -Pointers-References and Structures - Functions - Scope and Namespaces - Source Files and Programs.

UNIT II CLASSES AND OBJECTS 10 hrs.

Working with classes – Classes and objects – Class specification-Class objects-Accessing class members-Defining class members-Inline functions-Accessing member functions within class-Data hiding-Class member accessibility-Empty classes, constructors-Parameterized constructors-Constructor overloading-Copy constructors-new, delete operators-"this" pointer-friend classes and friend functions-Function overloading-Operator overloading.

UNIT III DERIVED CLASSES 10 hrs.

Base class and derived class relationship-Derived class declaration-Forms of inheritance-Inheritance and member accessibility- Constructors in derived class-Destructors in derived class-Multiple inheritance-Multi level inheritance-Hybrid inheritance-Virtual base classes-Member function overriding-Virtual functions.

UNIT IV I/O AND LIBRARY ORGANIZATION 10 hrs.

I/O Stream - File I/O - Exception Handling - Templates - STL – Library Organization and Containers – Standard Containers - Overview of Standard Algorithms-Iterators and Allocators.

UNIT V OBJECT ORIENTED DESIGN 10 hrs.

Development Process – Management - Object Identification – Components - Object Oriented Design Fundamentals – Case Studies.

TEXT / REFERENCE BOOKS:

1. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill,4th Edition,2010
2. Venu Gopal.K.R, Ravishankar.T, and Raj kumar, "Mastering C++", Tata McGraw Hill,1999.
3. Bjarne Stroustrup, "The C++ programming language", Addision Wesley, 3rd Edition,1998.
4. John R Hubbard, "Programming with C++", Shaums Outline Series, McGraw Hill, 2nd Edition, 2000.
5. James Martin & James J.Odell,"Object Oriented methods-A foundation",Prentice Hall,1997.
6. Grady Booch, "Object Oriented Analysis and Design with application", Addission Wesley, II Edition ,1994.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SEEX1002	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to Mech, Mech & Prod, Auto, Aero & Chem)	L	T	P	Credits	Total Marks
		2	1	0	3	100

BASIC ELECTRICAL ENGINEERING

UNIT I D.C.CIRCUITS 11 hrs.

Electrical quantities, Ohm's Law, Resistors - Series and parallel combinations, Kirchoff's laws, Node and Mesh Analysis - Star delta Transformation

UNIT II MAGNETIC CIRCUITS 8 hrs.

Definition of MMF, Flux and reluctance - Leakage factor - Reluctances in series and parallel (series and parallel magnetic circuits) - Electromagnetic induction - Fleming's rule - Lenz's law - Faraday's laws - statically and dynamically induced EMF - Self and mutual inductance - Energy stored and energy density - Analogy of electric and magnetic circuits

UNIT III A.C.CIRCUITS 11 hrs.

Sinusoidal functions - RMS(effective) and Average values- Phasor representation - J operator - sinusoidal excitation applied to purely resistive , inductive and capacitive circuits - RL , RC and RLC series and parallel circuits - power and power factor - Three phase circuits - Star / Mesh connections - with balanced loads - measurement of power by two wattmeter method.

TEXT BOOKS:

1. Mittle.B.N, Aravind Mittle, "Basic Electrical Engineering" , Tata McGraw Hill", 2nd Edition. Sep 2005
2. Theraja.B.L, "Fundamentals of Electrical Engineering and Electronics", S.Chand & Co., 1st Multicolor Edition, 2006 (Reprint 2009)

REFERENCE BOOKS:

1. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI Learning Private Ltd, 2nd Edition, 2010.
2. Wadhwa.C.L, "Basic Electrical Engineering", New Age International, 4th Edition, 2007. (Reprint June 2010)
3. Abhijit Chakrabarti, Sudipta nath & Chandan Kumar Chanda, "Basic Electrical Engineering", Tata McGraw Hill, 1st Edition, 2009.
4. T. Thyagarajan, "Fundamentals of Electrical Engineering", SciTech Publications, 5th Edition, Reprint Jan 2010

BASIC ELECTRONICS ENGINEERING

UNIT I SEMICONDUCTOR DEVICES AND LOGIC GATES 10 hrs.

Discrete devices - PN junction diodes - Zener diodes - Tunnel diodes- Thermistors - Bipolar junction transistors - Field effect transistors (FET and MOSFET) - Uni junction transistors - Silicon controlled rectifiers and Triacs. Universal Gates - Half Adder - Full Adder.

UNIT II RECTIFIERS, AMPLIFIERS AND OSCILLATORS 10 hrs.

Half and full wave rectifiers- Capacitive and inductive filters- ripple factor- PIV-rectification efficiency. CB, CE and CC Configuration - RC coupled amplifier- positive and negative feedback - Barkhausen criterion for oscillations - RC and LC oscillators.

TEXT / REFERENCE BOOKS:

1. Sedha.R.S, A Text book of Applied electronics, 2nd Edition, S.Chand & company, 2005.
2. Dr.Bhattacharya.S.K and Dr.Renu vig, Principles of electronics, 3rd Edition, S.K.Kararia & Sons, 2002.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80 Exam Duration: 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

(Distribution may be 70% Theory and 30% Numerical)

SPRX1001	BASIC MECHANICAL AND CIVIL ENGINEERING (Common to MECH, MECH & PROD, AUTO, CHEM, ECE, EEE, E&I, E&C and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

BASIC MECHANICAL ENGINEERING

UNIT I ENERGY SOURCES AND ENERGY CONVERSION 8 hrs.

Alternate sources of energy - solar, wind, wave, tidal and geo-thermal.

Boilers: Classification and principles of modern high pressure steam generators -Layout and working principles of hydraulic (hydel), steam, gas turbine, diesel and nuclear power plants.

UNIT II INTERNAL COMBUSTION ENGINES 8 hrs.

Working principle of petrol and diesel engines - Two stroke and four stroke engines - Ignition systems -single jet carburetor-spark plug-cooling systems- lubrication systems - fuel pump and fuel injector.

UNIT III MANUFACTURING PROCESSES 9 hrs.

Foundry process and technology: Foundry tools, pattern, moulding process.

Metal forming processes: Principles of forging, rolling, drawing and extrusion.

Metal joining process: Principles of welding - fundamentals of arc welding, gas welding and gas cutting - brazing and soldering.

Metal machining process: Lathe -Specifications - Main components and their functions-Lathe operations.

Machining Concept - Drilling, Milling, Turning, Grinding and surface Finishing.

BASIC CIVIL ENGINEERING

UNIT I BUILDING MATERIALS AND STRUCTURES 8 hrs.

Construction materials - Physical and Mechanical properties - stone, brick, cement, concrete, bitumen, insulation materials & steel. Buildings - various components and their functions. Foundation - functions - classification and suitability. Flooring - function - types - cement concrete, tile, marble and granite flooring. Masonry - Stone and Brick masonry and construction details. Roof - Types - Flat & sloped RCC roof. Introduction to seismic resistant structures.

UNIT II GENERAL PROPERTIES OF MATERIALS AND BUILDING VALUATION 8 hrs.

Stress, strain & modulus of elasticity. Simple maintenance methodologies, Valuation - plinth area method - depreciation rate method. Land development process - Set backs, Authorities involved. Basics of interior design and landscaping. Introduction to Orientation of the building & Energy efficient buildings.

UNIT III TRANSPORTATION AND SURVEYING 9 hrs.

Importance of Transport - Roads - Classification of roads - Traffic signs & signals - Surveying - Classification and principles - Applications of Theodolite and Total Station - Measurements of distances - angle - Computation of areas - Trapezoidal and Simpson's rule.

TEXT / REFERENCE BOOKS:

1. Ramamrutham S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. 1999
2. Shanmugam G and Palanichamy M S,"Basic Civil and Mechanical Engineering", Tata Mc Graw Hill Publishing Co., New Delhi, 2009.
3. Ramesh Babu.V, Text book on Basic Civil & Mechanical Engineering ,VRP publication,2009.
4. Helen Shanthi., Ramachandran. S and Premkumar, Basic Civil and Mechanical Engineering, Air Walk Publications, Chennai, 2009.
5. Natarajan K.V., Basic Civil Engineering, Dhanalakshmi Publications, 11th Edition, 2001
6. Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata Mc Graw Hill Publishing Co., New Delhi, 3rd Edition Reprint 2009.
7. Venugopal.K, Basic Mechanical engineering, Anuradha Publications, Kumbakonam, 2007.
8. Palani Kumar. K, Basic Mechanical Engineering, AirWalk Publications, Chennai-4, 2005
9. VenuGopal K. and Prabhu Raja V.,"Basic Civil and Mechanical Engineering", 3rd Edition, Anuradha Publications, 2010.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max.Marks: 80 Exam Duration : 3 hrs.

Basic Mechanical

Part A: 5 Questions of 2 marks each - no Choice	10 marks
Part B: 3 Questions from each of the three units of internal choice, each carrying 10 marks	30 marks

Basic Civil

Part A: 5 questions of 2 marks each - no Choice	10 marks
Part B: 3 questions from each of the three units of internal choice, each carrying 10 marks.	30 marks

SPRX4001	MECHANICAL WORKSHOP LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

LIST OF EXPERIMENTS

CARPENTRY

Handling of carpentry tools, A practice in marking, sawing planning and chiseling to size. Making simple joints such as half-lap, dove-tail and mortise and tenon joints.

Use of modern materials such as plywood, chip board, novapan, laminated sheet (demonstration only).

FITTING

Use of fitting tools-practice in marketing, fitting to size and drilling-making of simple mating and profiles such as V, Square, Dove-tail, Half-round joints.

WELDING

i. Electric Arc Welding
   a) Study on Edge preparation techniques for Arc welding
   b) List of Welding Exercises
      1. Lap Joint 2. Butt Joint 3. Fillet Joint 4. Tee Joint 5. V Joint 6. Corner Joint
ii. Study on gas welding and gas cutting
iii. Study on TIG & MIG welding

FOUNDRY

i. Sand testing - Grain fineness - Permeability test.
ii. Study on Pattern Allowances
iii. Preparation of green sand moulding
   1. Flanges 2. Glands 3. Bush 4. Dumbbell
iv. Metal casting technique (Demonstration only)

SCSX4007	PROGRAMMING IN C++ LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Write a program to calculate final velocity using the formula: v = u + a*t, with initial velocity, acceleration and time as input.
2. Write a program to find the area of square, rectangle, circle using function overloading concept.
3. Write a program to change the sign of an operands using unary operator overloading concept.
4. Write a program to add two complex numbers using binary operator overloading concept.
5. Write a program to find mean value of two integers using friend function concept.
6. Write a program to multiple and divide two different data type using inline function concept.
7. Implement parametrized constructor, default conctructor, copy constructor and destructor
8. Write a program to enter the sale value and print the agent's commission using single inheritance.
9. Write a program to enter salary and output income tax and net salary using multiple inheritance concept.
10. Write a program to enter the unit reading and output the customer's telephone bill using hierarchical inheritance.
11. Write a program to find the grade of the students based on academic marks and sports using multilevel inheritance.
12. Write a program having student as an abstract class and create many derived classes such as Engineering, Medical etc from student's class. Create their objects and process them.
13. Write a program to count the words and characters in given text using virtual function.
14. Write a program to calculate net pay of employee using virtual base class concept.
15. Write a program to calculate division of two number with a try block to detect and throw an exception if the condition" "divide by-zero" occurs.
16. Write a program to merge two files into one single file
17. Write a program to swap two values using funtion templates
18. Write a program to sort the numbers using class templates

SMTX1009	ENGINEERING MATHEMATICS III (Common to All Branches Except Bioinformatics)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I LAPLACE TRANSFORM **10 hrs.**

Transforms of simple functions – properties of transforms – Transforms of derivatives and Integrals – Periodic functions – Inverse transforms – Convolution theorems – Initial and final value theorems

UNIT II APPLICATIONS OF LAPLACE TRANSFORM **10 hrs.**

Application of Laplace Transforms for solving : linear ordinary differential equations – simultaneous differential equations – integral equations.

UNIT III COMPLEX VARIABLES **10 hrs.**

Analytic functions – Cauchy – Riemann equations in Cartesian and Polar form – properties of analytic functions – construction of analytic functions – conformal mapping – standard types – bilinear transformations.

UNIT IV COMPLEX INTEGRATION **10 hrs.**

Cauchy's integral theorem – integral formula – Taylor's and Laurent's series (without proof) – Residues – Cauchy's residue theorem – Contour integration and the circle and semi circular contours.

UNIT V THEORY OF SAMPLING AND TEST OF HYPOTHESIS **10 hrs.**

Test of Hypothesis – Large sample – test of significance – single proportion - difference of proportions – Single mean - difference of means. Small sample – students 't' test – single mean – difference of means – Fisher's test – difference of variance, Exact sample – Chi square test – goodness of fit – independence of attributes.

TEXT / REFERENCE BOOKS:

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics", Volumes II & III (4th Revised Edition), S. Chand & Co., New Delhi, 2001.
2. Venkataraman, M.K. "Engineering Mathematics" Volumes III - A & B, 13th Edition National Publishing Company, Chennai, 1998.
3. Veerarajan, T., "Engineering Mathematics", Tata McGraw Hill Publishing Co., NewDelhi, 1999.
4. Grewal, B.S., "Higher Engineering Mathematics" (35th Edition), Khanna Publishers, Delhi, 2000.
5. Kreyszig, E., "Advanced Engineering Mathematics" (8th Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2001.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMTX1003	KINEMATICS OF MACHINES (Common to Mech & Auto)	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I BASICS OF MECHANISMS **10 hrs.**

Definitions: Links- Rigid, flexible and fluid links. Kinematic pairs – Degrees of freedom, Kutzbach criterion, Grubler's criterion (without derivation), Mechanism, structure, Mobility of Mechanism, Kinematic chains and inversions: Grashof's law – Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

UNIT II KINEMATICS OF LINKAGE MECHANISMS **10 hrs.**

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method, Klein's construction: Analysis of velocity and acceleration of single slider crank mechanism. Coriolis component of acceleration

UNIT III KINEMATICS OF CAM MECHANISMS **10 hrs.**

Types of cams, Types of followers, Terminology and definitions. Displacement diagrams- SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.Graphical construction of Cam profiles- Disc cam with knife-edge, roller , flat-faced followers and oscillating roller follower.

UNIT IV GEARS AND GEAR TRAINS **10 hrs.**

Spur Gear terminology, law of toothed gearing- involute and cycloidal tooth profiles – Path of contact, Arc of contact, Contact ratio, Interference and Methods of avoiding interference in involute gears, Back lash, Comparison of involute and cycloidal teeth. Basics of helical,bevel, worm and rack and pinion gears (Basics only).Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains – tabular method of finding velocity ratio.

UNIT V FRICTION **10 hrs.**

Introduction – Dry friction – Plate clutches. Belt drives – Flat & V belt drives – Materials used for belts, Velocity ratio, slip, creep. Ratio of driving tensions, angle of contact, centrifugal tension, Maximum tension of belt – power of transmission.

TEXT / REFERENCE BOOKS:

1. Rattan.S.S,"Theory of Machines", 2nd Edition,Tata McGraw Hill Publishers, 2005
2. Ghosh A and Mallick.A.K,"Theory of Mechanisms and Machines",3rd Edition,Affiliated East-West Pvt. Ltd., New Delhi,2000
3. Rao J.S and Dukkipati R.V, "Mechanism and Machines Theory", Wiley-Eastern Ltd., New Delhi, 2007.
4. Khurmi.R.S & Gupta.J.K, "Theory of Machines", 15th Revised Edition,Eurasia Publishing House Pvt Ltd,1997
5. SHIGLEY J.E, "Theory of Machines and Mechanisms", 2nd Edition, McGraw Hill Inc., 1995

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : **80% Problem and 20% Theory**
2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1004	ENGINEERING THERMODYNAMICS (Common to MECH, M&P AERO & AUTO)	L	T	P	Credits	Total Marks
		2	1	0	3	100

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted)

UNIT I BASIC CONCEPT AND FIRST LAW **10 hrs.**

Basic concepts – concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW AND ENTROPY **10 hrs.**

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy, availability.

UNIT III PROPERTIES OF PURE SUBSTANCES **10 hrs.**

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS **10 hrs.**

Gas mixtures – Properties of ideal and real gases – Equations of state – Avagadro's law- Vanderwaal's equation of state – compressibility factor – compressibility chart – Dalton's law of partial pressure – Exact differentials – T-ds relations – Maxwell's relations – Clausius Clapeyron equations – Joule – Thomson coefficient.

UNIT V PSYCHROMETRY **10 hrs.**

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems.

TEXT / REFERENCE BOOKS:

1. Nag.P.K., "Engineering Thermodynamics", 4th Edition, Tata McGraw-Hill, New Delhi,2008
2. Lynn D Russell, George A, Adebiyi "Engineering Thermodynamics",6th Edition, Indian Edition, Oxford 3, University Press, New Delhi, 2008.
3. Yunus A Cengel and Michael Boles, "Thermodynamics An Engineering Approach", 6th Edition, McGraw Hill,2008
4. Ratha Krishnan.E, "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice – Hall of India Pvt. Ltd, 2006
5. Arora C.P, " Thermodynamics", 2nd Edition, Tata McGraw-Hill, New Delhi, 2003.
6. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", 2nd Edition,Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2009
7. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
8. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : **80% Problem and 20% Theory**
2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1005	FLUID MECHANICS AND MACHINERY (Common to Mech, M&P, Auto, Aero)	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I FLUID PROPERTIES **10 hrs.**

Fluid Properties: Density – Specific Weight – Specific Gravity – viscosity – surface tension – capillarity – compressibility.

Fluid Statics: Hydrostatic Law – Pressure Variation in static fluid – Hydrostatic force on a submerged plane surfaces – Location of hydrostatic force. Manometers – Simple U tube and differential manometers – Buoyancy –

Meta-centric height – determination of stability of floating bodies and submerged bodies.

UNIT II EQUATIONS OF MOTION **10 hrs.**

Basic equations of motion: Types of fluid flow – Continuity, momentum and energy equations – Euler's and Bernoulli's Equation and its applications.

Flow Measurement: Orifice meter, Venturi meter, Piezometer, Pitot Tube.

UNIT III FLOW THROUGH ORIFICES, LAMINAR AND TURBULENT FLOW **10 hrs.**

Flow through orifices: Classification – Hydraulic co-efficient – Flow through rectangular orifice, Notches and weirs.

Laminar and Turbulent flow: Reynolds experiment – Major and minor losses in pipes – Darcy weisbach's equation, chezy's formula – pipes in series and pipes in parallel – total energy line – hydraulic gradient line – Equivalent pipe

UNIT IV PUMPS **10 hrs.**

Centrifugal Pumps: Definition – Operations – Velocity Triangles – Performance curves – Cavitations – Multistaging.

Reciprocating Pumps: Operation – Slip – indicator Diagram – Separation – Air vessels.

UNIT V TURBINES AND DIMENSIONAL ANALYSIS **10 hrs.**

Hydraulic Turbines: Classification of hydraulic turbines – Working principle of Pelton wheel, Francis and Kaplan turbines – velocity triangles – draft tube – hydraulic turbine characteristics.

Dimensional Analysis: Buckingham's Theorem, Non-Dimension Numbers, Similarities of Flow. Model studies

TEXT / REFERENCE BOOKS:

1. Bansal.R.K,". Fluid Mechanics & Hydraulics Machines", 9th Edition,Laxmi Publications, 2005.
2. Douglas. J. F., Gasiorek. J. M., Swaffield. J. A., "Fluid Mechanics ELBS", 4th Edition,Prentice Hall,2000
3. Modi P. N., Seth S. M., "Hydraulics and Fluid Mechanics", Standard Book House, 1987
4. Kumar K. L., "Engineering Fluid Mechanics", 8th Edition, Eurasia Publication.2009
5. Govinda Rao N. S., "Fluid Flow Machines", 2nd Edition,Tata McGraw Hill, New Delhi, 1990.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : **80% Problem and 20% Theory**
2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1006	MATERIAL TECHNOLOGY (Common to Mech, M&P, Auto)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION 10 hrs.

Basic Principles: Crystal structures – BCC –FCC –HCP –Methods to determine crystal structure – Atomic radius –APF – Allotropy –Solid solution – Intermetallic compounds

Phase diagrams: Solidification of metals, phase rules, construction of phase diagram, Isomorphous, eutectic diagram showing partial solid solubility, peritectic system. Non-equilibrium cooling of above types of alloys Equilibrium solid state reactions.

UNIT II FERROUS AND NON-FERROUS ALLOYS 10 hrs.

Fe-Fe3C diagram, Cooling Curves of pure Fe, Critical points in Fe – Fe3C equilibrium diagrams, Phase changes. Simple calculation of amount of phases. Plain carbon steels, Effect of alloying elements on steel, Alloy steel, IS designation of steels – classification of cast iron ,Properties and Uses

Composition and uses of important aluminium based alloys, copper based alloys and Nickel based alloys.

UNIT III HEAT TREATMENT OF STEEL 10 hrs.

Non-equilibrium transformation of austenite – Annealing, Normalizing, spheroidizing, TTT diagram. Continuous cooling transformation diagram – Hardening and tempering, martempering, austempering – Hardenability and its determination – Surface hardening processes. Heat treatment of non-ferrous alloys –Age hardening, precipitation hardening

UNIT IV POWDER METALLURGY 10 hrs.

Introduction, Methods of production of metal powder – mixing – blending – compacting – sintering –hot pressing – secondary and finishing operations – Advantages and applications.

UNIT V MECHANICAL PROPERTIES AND TESTING 10 hrs.

Elastic and plastic deformation of metals – elastic effects – Deformation by slip Tensile test – Stress – strain curve for mild steel & brittle material, determination of yield, ultimate stresses, and percentage elongation- Impact tests. Ductile – Brittle transition – fatigue and creep Stress cycle for fatigue testing, endurance limit. Fatigue limit, S-N Curve, Creep Curve

Fracture: Ideal fracture, brittle fracture, Griffith's theory – fracture toughness, ductile failure cup and cone. Type of fracture. Fatigue failure, crack propagation.

TEXT / REFERENCE BOOKS:

1. Avener S.H, "Introduction to Physical Metallurgy", 2nd Edition,McGraw Hill, NY,1990
2. Raghavan.V, Material Science and Engineering", 5th Edition,Prentice Hall, 2005
3. Khurmi.R.S, SEDHA R.S, "Material Science",4th Edition,S. Chand & Co.,2009
4. Dieter.G.E, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 1986

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : **100% Theory**
2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SEEX1004	ELECTRICAL TECHNOLOGY (Common to ECE, E&C , EIE, ETCE, MECH, M&P)	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I DC GENERATORS **11 hrs.**

Construction- Principle of operation - EMF equation types - performance characteristics- losses in dc generator - calculation of efficiency - Applications.

UNIT II DC MOTORS **10 hrs.**

Construction - Principle of operation - Significance of Back EMF - Types - Performance characteristics - Torque Equation - Losses in dc motors - Calculation of efficiency - Starters - Necessity and their types - Speed control of various types of DC motors - Applications.

UNIT III TRANSFORMERS **11 hrs.**

Constructional details and principle of operation of single phase transformer - EMF equation - Phasor diagram on no load and loaded transformer - Equivalent circuit - Open circuit and Short circuit test on transformer - Regulation and Efficiency - All day efficiency - Auto transformer.

UNIT IV INDUCTION MOTORS (Qualitative treatment only) **10 hrs.**

Constructional details of three phase induction motor - Slip ring and squirrel cage rotor- principle of operation- Torque equation - torque / slip characteristics - starters-Applications

Introduction to single phase Induction motors - Capacitor start capacitor run motor -Shaded pole motor.

UNIT V SYNCHRONOUS MACHINES AND SPECIAL MACHINES (Qualitative treatment only) **8 hrs.**

Constructional features of Alternator - principle of operation - EMF equation - Regulation - Regulation by synchronous impedance method - Application, Constructional features of synchronous motor - principle of operation - V and "inverter V" curves, starting and hunting - Applications.

Special Machines: Stepper motor, AC and DC servomotor - Construction, working and applications.

TEXT BOOKS:

1. Theraja B.L. & Theraja A.K., "A Text Book of Electrical Technology, Vol II", S.Chand & Company Ltd., 2009.
2. Gupta J.B., "Theory and Performance of Electrical Machines", S.K.Kataria & Sons, 4th Edition, 2006

REFERENCE BOOKS:

1. Rajput R.K. "Electrical Engineering", 4th Edition, Lakshmi Publications Pvt Limited, 2008
2. Bhattacharya S.K., "Electrical Machines", 3rd Edition, Tata McGraw Hill Company Ltd, 2008.
3. Kothari D.P.& Nagrath I.J., "Electrical Machines", 3rd Edition, Tata McGraw Hill Company Ltd, 2004

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

(Distribution may be 80% Theory & 20 % Numericals)

SMEX1007	MACHINE DRAWING	L	T	P	Credits	Total Marks
III SEM	(Common to Mech, M & P, Auto, Aero)	1	2	0	3	100

UNIT I DRAWING STANDARDS **10 hrs.**

BIS code of practice for Engineering Drawing – Machine Drawing Conventions – Need for drawing conventions – Conventional representation of common machine elements such as screws, bolts, nuts, keys, gears, bearings, couplings, webs, ribs etc., - Abbreviations and symbols for use in technical drawings - Types of sections – Parts not usually sectioned.

UNIT II FITS, TOLERANCES AND PREFERRED NUMBERS **10 hrs.**

Fits – Types of fits – Allocation of fits for various machine parts – Tolerances – Types – Representation on the drawing – Tolerance data sheet – Geometric tolerance – Preferred numbers

UNIT III MANUFACTURING DRAWING (Only for practice; Not to be asked in the examination) 15 hrs.

Preparation of manufacturing drawing for the following machine components: Hexagonal headed bolts- Nuts – Square headed bolts – Cotter joints – Cotter joint with Sleeve – Socket and Spigot Cotter joint – Cotter joint with Gib and Cotter – Knuckle joint

UNIT IV ASSEMBLY DRAWING **15 hrs.**

Preparation of assembled views from the given parts – Screw jack – Plummer block – Snug and octagonal type – Swivel bearing – Lathe tail stock – Steam stop valve – Machine vice - Petrol Engine Connecting rod – Cross head for horizontal and vertical steam engine.

TEXT BOOKS:

1. Gopala Krishnan.K.R,"Machine Drawing ", 16th Edition, Sabhas Publications, 2008
2. N. D. Bhatt.N.D," Machine Drawing", 44th Edition, Charotar Publishing House, 2009
3. PSG Design Data Book

REFERENCE BOOKS:

1. Gill.P.S,"Machine Drawing". 5th Edition, S.K.Kataria & Sons,2009
2. Gupta.R.B,"Machine Drawing ", 1st Edition, Satya Prakash & Sons, 2006

UNIVERSITY EXAM QUESTION PAPER PATTERN

Note: 1. Question Paper will consists of two parts (A & B) of 3 hours duration.

2. All the students will have to submit all the drawing sheets in a file periodically for continuous assessment.

Part A:	Problems on Limits (finding upper limit and lower limit)	: 10 Marks
	Problems on Clearance Fit / Interference fit / Transition fit	: 15 Marks
	Conventions symbols and abbreviations	: 5 Marks
Part B:	Assembly Drawing (only full sectional front view / top view)	: 50 Marks

SMEX4001	FLUID MECHANICS LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Determination of Friction Coefficient using Pipe Friction apparatus
2. Determination of Co-efficient of discharge of Venturimeter
3. Determination of Co-efficient of discharge of Orificemeter
4. Determination of Co-efficient of discharge of Notches
5. Determination of Metacentric Height of Ship model
6. Determination of Co-efficient of discharge of Orifice and Mouth Piece
7. Determination of Co-efficient of velocity of Pitot tube.

SMEX4002	METALLURGY LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Specimen preparation: macro and micro etching techniques for metallographic examination.
2. Study of metallurgical microscope and image analyzer, different types and their operations.
3. Study of the micro structure of pure metals like Iron, Cu and Al.
4. Study of the microstructure of cast iron, mild steels, low carbon steels, high-c steels, heat treated steels.
5. Study of microstructure in Al, Brass and Bronze.
6. Study of micro phases present in plain carbon and high carbon steels low alloy steel, quenched and tempered steel and stainless steel.
7. Grain size measurement by comparison with ASTM charts.
8. Comparison of microstructure and hardness values before and after heat treatment such as annealing, normalizing, hardening and tempering.
9. Measurement of hardenability – Jomny test.
10. Micro structural study of a steel weldment.

SEEX4001	ELECTRICAL ENGINEERING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Open circuit characteristics of separately excited dc shunt generator.
2. Load characteristics of self excited dc shunt generator.
3. Load characteristics of dc Compound generator.
4. Load characteristics of dc shunt motor.
5. Speed control of dc shunt motor.
6. Load characteristics of dc series motor.
7. Open circuit and short circuit test on single phase transformer.
8. Load test on single phase transformer.
9. Brake load test on three phase squirrel cage induction motor.
10. Regulation of alternator by EMF method.
11. Measurement of 3 phase power by two wattmeter method.
12. Wiring circuits for

    A. Calling bell B. Stair case C. Fluorescent lamp

SMTX 1010	ENGINEERING MATHEMATICS IV (Common to All Branches Except Bio Informatics)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I PARTIAL DIFFERENTIAL EQUATION **10 hrs.**

Formulation of equations by elimination of arbitrary constants and arbitrary functions-solutions by equations-general, particular and complete integrals-Lagrange's linear equation-standard type of first order equation-second and higher order equations with constant coefficients-homogenous equations.

UNIT II FOURIER SERIES **10 hrs.**

Euler's formula-Dirichlets conditions-convergence statement only-change of interval-odd and even functions-half range series-RMS value-Parseval's formula-complex form of Fourier series-harmonic analysis.

UNIT III WAVE AND HEAT EQUATION **10 hrs.**

One dimensional wave equation-Transverse vibration of finite elastic string with fixed ends-boundary and initial value problems-Fourier series solution-Derivation of one dimensional heat equation-steady and unsteady state-boundary and initial value problems-Fourier series solutions. Two dimensional heat equation-steady state heat flow in two dimensions-Laplace equation in Cartesian coordinates - Fourier series solution.

UNIT IV FOURIER TRANSFORM **10 hrs.**

The infinite Fourier transform-sine and cosine transform-Properties-Inversion theorem-Finite Fourier transform-sine and cosine transform-Convolution theorem-Parseval's identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS **10 hrs.**

Z – Transforms – Elementary Properties – Inverse Z – transforms – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transforms.

TEXT / REFERENCE BOOKS:

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics", Volumes II & III (4th Revised Edition), S. Chand & Co., New Delhi, 2001.
2. Venkataraman, M.K. "Engineering Mathematics" Volumes III - A & B, 13th Edition National Publishing Company, Chennai. Engineering Mathematics – Dr. T.Veerarajan, Tata McGrawhill Company, 1998.
3. Veerarajan, T., "Engineering Mathematics", Tata McGraw Hill Publishing Co., New Delhi, 1999.
4. Grewal, B.S., "Higher Engineering Mathematics" (35th Edition), Khanna Publishers, Delhi, 2000.
5. Kreyszig, E., "Advanced Engineering Mathematics" (8th Edition), John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1008	DYNAMICS OF MACHINERY (Common to Mech & Auto)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I FORCE ANALYSIS AND FLYWHEELS **10 hrs.**

Static force analysis of mechanisms – D' Alemberts principle - Inertia force and Inertia torque – Dynamic force analysis - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque.

Turning moment diagrams – Fluctuation of Energy and speed – Energy stored in Flywheel – Mass of Flywheel – Dimensions of Flywheel

UNIT II BALANCING **10 hrs.**

Balancing – Static and Dynamic Balancing of Rotating Masses - Balancing of several masses rotating in same plane and in different planes

Partial Balancing of locomotives – Variation of tractive force, Hammer blow and swaying couple – Balancing of primary and secondary forces in In-line engines.

UNIT III FREE VIBRATION **10 hrs.**

Basic features of vibratory systems - Lumped mass parameter systems - Degrees of freedom - Free vibration of Longitudinal, Transverse and Torsional systems of Single degree of freedom - Equations of motion - Natural frequency – Whirling of shafts and critical speed - Dunkerley's Method – Torsional vibration of Two and Three rotor system.

Damped free vibration - Types of Damping –Critical damping coefficient - Damping Factor – Logarithmic Decrement.

UNIT IV FORCED VIBRATION **10 hrs.**

Forced vibration of single degree freedom system with damping - Response to periodic forcing- Harmonic Forcing- Force transmissibility and amplitude transmissibility

Reciprocating and rotating unbalance - vibration isolation and transmissibility - Support motion - self excited vibration with examples

UNIT V MECHANISMS FOR CONTROL **10 hrs.**

Governors - Types - Centrifugal governors – Porter, Proel and Hartnell Governors – Characteristics –Sensitivity – Stability – Hunting – Isochronisms – equilibrium speed - Effect of friction - Controlling Force

Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Aeroplanes and ships.

TEXT / REFERENCE BOOKS

1. Khurmi R.s & Gupta J.S, "Theory of Machines", 16th Edition, S.Chand & Company, 2005.
2. Singh V.P, "Mechanical Vibrations", 3rd Edition, Dhanpatrai & Co., 2006.
3. Ghosh A. and Malik A.M, "Theory of Mechanism and Machines", 3rd Edition, Affiliated East West Press (P) Ltd. 2000.
4. Ashok G. Ambekar, "Mechanism and Machine Theory", PHI Learning Private limited 2009.
5. Grover G.K, "Mechanical Vibrations", 3rd Edition, Nemchand & Brothers 1996.
6. Rao J.S Dukkipatti, "Mechanisms and Machines Theory", 2nd Edition - Wiley Eastern Ltd. 1992.
7. Hamilton H. Mabic and Charles F. Reinnoltz, "Mechanisms and Dynamics of Machinery", 4th Edition, John Wiley & Sons, 1987.
8. Shigley, J.E., "Theory of Machines and Mechanisms", 2nd Edition, McGraw Hill Inc., 1995.
9. Thomson W.T., "Theory of Vibration with Applications", 5th Edition, Prentice Hall of India (P) Ltd., 1997.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : **80% Problem and 20% Theory**
2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1009	THERMAL ENGINEERING	L	T	P	Credits	Total Marks
		3	1	0	4	100

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted in the examination)

UNIT I GAS POWER CYCLES **10 hrs.**

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of Four stroke engines, Actual and theoretical PV diagram of two stroke engines. Numerical Problems.

UNIT II INTERNAL COMBUSTION ENGINES **10 hrs.**

Classification of IC engine, IC engine components and functions. Valve timing diagram and port timing diagram. Comparison of two stroke and four stroke engines. Fuel supply systems, Ignition Systems, Performance calculation. Comparison of petrol & diesel engine. Fuels, Air-fuel ratio calculation, Knocking and Detonation. Lubrication system and cooling system. Exhaust gas analysis, pollution control norms. Numerical Problems.

UNIT III STEAM NOZZLES AND TURBINES **10 hrs.**

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines, speed regulations-governors and nozzle governors. Numerical Problems.

UNIT IV AIR COMPRESSOR **10 hrs.**

Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – work of multistage air compressor, various types of compressors (Descriptive treatment only). Numerical Problems.

UNIT V REFRIGERATION AND AIR-CONDITIONING **10 hrs.**

Vapour compression Refrigeration cycle – super heat, sub cooling, performance calculations. Working principle of vapour absorption system. Ammonia – water, Lithium bromide – water systems (Description only), Comparison between vapour compression and absorption systems. Psychrometry, Psychometric chart, Cooling load calculations. Concept of RSHF, GSHF, ESHF, Air conditioning systems. Numerical Problems.

TEXT / REFERENCE BOOKS:

1. Rajput, "Thermal Engineering", 6th Edition, Laxmi Publications, 2006.
2. Rudramoorthy R, "Thermal Engineering", 2nd Edition, Tata McGraw-Hill, New Delhi, 2003.
3. Kothandaraman.C.P., Domkundwar.S. and Domkundwar.A.V, "A course in Thermal Engineering", Dhanpat Rai & Sons, 5th Edition, 2002
4. Holman. J.P., "Thermodynamics",4th Edition, McGraw-Hill, 1998.
5. Rogers, Meyhew, "Engineering Thermodynamics", 2nd Edition, ELBS, 1992.
6. Arora.C.P., "Refrigeration and Air conditioning", TMH, 1994.
7. Sarkar B.K, " Thermal Engineering", 3rd Edition,Tata McGraw-Hill, 2006.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : **80% Problem and 20% Theory**
2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1010	STRENGTH OF MATERIALS (Common to Mech, M&P, Civil, Chem)	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Stress and strain – Application to uniform and varying Composite sections, Elastic constants, Stress – Strain diagram for brittle and ductile materials, Thermal stress, Definition of fatigue and creep.

UNIT II BENDING MOMENT AND SHEAR FORCE **10 hrs.**

Types of Beams, Supports and Loads – Concept and significance of shear force and bending moment – Shear force and Bending moment diagram for cantilever, simply supported and overhanging beams.

UNIT III BENDING AND SHEAR STRESS DISTRIBUTION, TORSION **10 hrs.**

Stresses in Beams – Simple bending theory – Composite Beams – Combined bending and direct stress – Shear stress distribution for Rectangular and I section – Simple Torsion theory – Stresses in Solid and Hollow circular shafts

UNIT IV SLOPE AND DEFLECTION OF BEAMS **10 hrs.**

Double integration method – Macaulay's method – Moment area method – Conjugate method for simply supported and cantilever beams, (only point loads & Uniformly distributed loads.)

UNIT V THIN CYLINDERS AND SPHERES, THICK CYLINDERS **10 hrs.**

Stresses and deformation in thin cylinders and spherical shells subjected to internal pressure. Thick cylinders – Hoop and radial stress variation, Lame's equation, Compound cylinders – Shrink fit

TEXT / REFERENCE BOOKS:

1. Ramamrutham.R., "Strength of Materials" ,16th Edition, Dhanpat Rai Publishing company, 2007.
2. Bansal.R.K., "Strength of Materials", 4th Edition, Laxmi Publications, 2007.
3. Vazirani. V.N. & Ratwani, N.M., "Strength of Materials", 2nd Edition, Vol-I, Khanna Publishers, 1996.
4. Punmia.B.C, "Strength of Materials", 2nd Edition, Laxmi Publications, 1992.
5. Rajput.R.K. "Strength of Materials"4th Edition, S.Chand & co, New Delhi, 2002.
6. Khurmi, R.S, "Strength of Materials", 23rd Edition,S.Chand & Co, 2008
7. Timoshenko.S.P. and Gere.J.M, "Mechanics of Materials", 5th Edition,Tata McGraw Hill, 2003.
8. Egor P. Popov, "Introduction of Mechanics of Solids", 2nd Edition, Prentice Hall of India, New Delhi, 1996.
9. Harvey ,"Design of Pressure vessels"1st Edition, 1991

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

Part B : **100% Problem**

2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1042	MANUFACTURING TECHNOLOGY - I	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I METAL CASTING PROCESSES **10 hrs.**

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces – Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO_2 process – Sand Casting defects – Inspection methods

UNIT II JOINING PROCESSES **10 hrs.**

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot welding – seam welding – Percusion welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering process – Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES **10 hrs.**

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the process – Types of Forging Machines – Typical forging operations – Rolling of metals – Types of Rolling mills - Flat strip rolling – Shape rolling operations – Defects in rolled parts - Principle of rod and wire drawing - Tube drawing – Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion – Equipments used.

UNIT IV SHEET METAL PROCESSES **10 hrs.**

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations — Formability of sheet metal – Test methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming.

UNIT V MANUFACTURING OF PLASTIC COMPONENTS **10 hrs.**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Compression moulding, Transfer moulding - Typical industrial applications – Introduction to Blow moulding – Rotational moulding – Film blowing – Extrusion - Thermoforming - Bonding of Thermoplastics.

TEXT BOOK

1. Hajra Choudhury S.K. and Hajra Choudhury A.K., "Element of Manufacturing Technology Vol. I", Media Publications, 2009.

REFERENCE BOOKS

1. Kalpakjian S., "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006.
2. Rao P.N., Manufcturing Technology Foundry, Forming and Welding, TMH, 2009.
3. Roy A. and Lindberg, "Process and Material Manufacture". PHI 1995.
4. Sharma P.C., "A Text book of Production Technology", S. Chand and Co. Ltd., 2004.
5. Rao P.N., Manufacturing Technology Vol. II Metal cutting and Machine Tools, 2009.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1007	CAD/CAM (Common to Mech, Mech & Prod)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO CAD/CAM **10 hrs.**

The design process Morphology of design, Product cycle Computer Aided Design, Benefits of CAD. Basic concepts of CAD - principles of computer graphics . CAD/CAM data base development and data base management systems. Programming and interface hardware – computer aided process monitoring - adaptive control, on-line search strategies.

UNIT II CURVES & SURFACES AND 2D & 3D TRANSFORMATION **10 hrs.**

Analytic curves and surfaces, 2D homogenous transformations- translation, rotation, reflection, scaling, shearing and combined transformation

3D homogenous transformation - translation, rotation, reflection, scaling, shearing and combined transformation

3D viewing transformation – panning, rotation, reflection, shearing and zooming

UNIT III COMPUTER AIDED DRAFTING AND SOLID MODELING **10 hrs.**

Graphic software: coordinate representation- graphic functions, software standards. Graphical Kernal system (GKS) - Initial graphics exchange system (IGES) - Graphic packages. Geometric Modeling - Wire frame, Surface and Solid models - Constructive Solid Geomentry (CSG) and Boundary Representation (B-REP) Techniques - Features of Solid Modeling Packages

UNIT IV COMPUTER AIDED MANUFACTURING **10 hrs.**

Manufacturing Planning and Control - CAD/CAM Integration - Principles of Computer Integrated Manufacturing - Hierarchical Network of Computers - Local Area Networks - Process Planning - Computer Aided Process Planning - Retrieval and Generative approaches.

UNIT V COMPUTER AIDED PROCESS PLANNING AND SHOP FLOOR CONTROL **10 hrs.**

Computer Integrated Production Management System - Master Production Schedule - Material Requirement Planning - Inventory Management - Manufacturing and Design Data Base - Capacity Planning - Shop Floor Control - Functions - Order release - Order Scheduling - Order progress - Factory data collection.

Total: 50 hrs.

TEXT / REFERENCE BOOKS:

1. M.E. Mortenson, Geometric modeling, John Willey & Sons, 1985
2. D.F. Roger and J.A. Adams, Mathematical elements of computer graphics, McGraw Hill, 1990
3. M. P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall, 2007.
4. P. Radhakrishnan, S. Subramanyan, V. Raju, “CAD/CAM/CIM”, New Age International Publishers(P) Ltd., 2006.
5. Ibrahim Zeid:CAD/CAM Theory and practice:,tatamcgraw hill corporation co.ltd,1988.
6. Hearn, Donald and M.Pauline Baker, “computer Graphics “, Prentice Hall 1986

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX4003	FLUID MACHINERY LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Study of Centrifugal Pump
2. Performance characteristics of Centrifugal Pump
3. Study of Reciprocating Pump
4. Performance characteristics of Reciprocating Pump
5. Performance characteristics of Multistage Centrifugal Pump
6. Performance characteristics of Gear Pump
7. Performance characteristics of Jet Pump
8. Performance characteristics of Deep well Turbine Pump
9. Study of Pelton Wheel Turbine
10. Performance characteristics of Pelton Wheel Turbine
11. Performance Characteristics of Francis Turbine
12. Performance characteristics of Kaplan Turbine.

SMEX4004	MATERIAL TESTING LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Evaluation of Engineering stress/ strain diagram on steel rod, Thin Wire and Twisted bars under tension.
2. Compression Test on bricks. Concrete blocks.
3. Deflection Test – Verification of Maxwell theorem
4. Comparison of hardness values of Steel, Copper and aluminium using Brinell and Rockwell hardness measuring machines.
5. Estimation of spring constant. Under tension and compression.
6. Estimation of notch toughness of steel using a Charpy/Izod impact testing machine.
7. Double shear test in U.T.M.
8. Hardness values of Steel, Copper and aluminium using Vicker's hardness tester.
9. Load measurement using Load indicator, Load coils.
10. Strain Measurement using Rosette Strain Gauge.

SPRX4008	MACHINE SHOP PRACTICE LAB - I	L	T	P	Credits	Total Marks
		0	0	2	1	50

WORKSHOP

1. Study of Lathe - types - Accessories - Capabilities and Progress - Specification

2. Lathe Operations:

   (i) Exercise on plain turning
   (ii) Exercise on Step Turning & Knurling
   (iii) Exercise on Taper turning
   (iv) Exercise on Grooving and Under cutting
   (v) Exercise on Single start-Thread cutting
   (vi) Exercise on Double start-Thread cutting
   (vii) Exercise on Eccentric turning

3. Exercises on Drilling and Boring

4. Exercise on thread manufacturing (internal and external)

SPRX4009	CAD LAB – II	L	T	P	Credits	Total Marks
		0	0	2	1	50

Description: It teaches you how to use the Mechanical Design Automation software to build parametric models of parts and how to make drawings of those parts.

Introduction to computer aided drawing

2-D drawing:

Orthographic Views, Isometric Views, 2-D Sectional Views, Part Drawing, Assembly Drawing, Broken views, Detailed Drawing. Dimensioning, Annotations, Symbols - Welding, Surface Finish, Threads. Text, Bill of Materials, Title Block. Exercises - Knuckle Joint, Gib and Cotter Joint, Screw Jack, Foot Step Bearing.

3D Drawing :

Isometric Drawing's of simple blocks by using solid commands- Extrusion – revolve- Modify commands- extrude, extrude cut, revolve cut, hole wizard, fillet, chamfer, mirror, rib, sweep, draft, Pattern, Shell etc- View commands – render- wire frame- Shade- View ports- Generating Orthographic view from Isometric View. File Management – DXF – IGES – SAT – DWG –PRT – Para solid, VRML.

Note: Exposure to at least one popular 3D Modeling Software is essential.

SMTX1011	APPLIED NUMERICAL METHODS (Common to Mech, M & P, Aero, Auto, Civil, Chem, E&I, ECE, EEE, E&C and ETCE)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I CURVE FITTING AND RELATION BETWEEN OPERATORS **10 hrs.**

Curve Fitting-Method of group averages-Principle of least squares-Method of moments-Finite Differences-Operators E & D-Relationship between operators.

UNIT II INTERPOLATION **10 hrs.**

Interpolation-Newton's method-Lagrange's method-Numerical Differentiation and Integration-Trapezoidal and Simpson's Rule-Finite Difference Equations.

UNIT III ALGEBRAIC AND TRANSCENDENTAL EQUATIONS **10 hrs.**

Numerical solution of Algebraic and Transcendental Equations-Regula Falsi method-Newton Raphson method-Graffe's Root Squaring method-Simultaneous linear algebraic equations- Gauss Jordan method-Crout's method-Gauss Seidel method-Relaxation method.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS **10 hrs.**

Numerical solution of Ordinary Differential Equations-Taylor's series-Modified Euler's method-Runge Kutta method of fourth order-Predictor-Corrector methods-Milne's method-Adam's Bashforth method.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS **10 hrs.**

Numerical solution to Partial Differential Equations-Classification-Elliptic equations-Poisson's equations-Leibmann's iteration procedure-Parabolic equation-Bender Schmidt Scheme-Crank Nicholson's Scheme-Hyperbolic equations.

TEXT / REFERENCE BOOKS:

1. Kandasamy P & Co., Numerical Methods, S.Chand & Co., New Delhi, 2003.
2. Venkataraman M.K., Engineering Mathematics – First Year, 2nd Edition, National Publishing Co., 2000.
3. Grewal, B.S., "Higher Engineering Mathematics", 35th Edition, Khanna Publishers, Delhi, 2000.
4. Balgurusamy .E, Numerical Methods, Tata McGraw Hill, New Delhi, 2006.
5. Steven C.Chapra, Raymond P. Canale, Numerical Methods for Engineers, Tata McGraw Hill, New Delhi, 2003.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SECX1011	MICROPROCESSORS AND MICROCONTROLLERS (Common to MECH, AUTO Branches)	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I MICROPROCESSORS 8085 **10 hrs.**

Microcomputer System – 8085 Architecture – 8085 Pin Diagram – Buses and Memory Operations - Addressing Modes, Basic concepts of microprocessor programming – Mnemonics – Hex code – fundamentals of assembly language - Instruction set for 8085.

UNIT II MICROPROCESSOR PROGRAMS AND INTERFACING - 8085 **10 hrs.**

Program format - Simple programs – Addition, Subtraction, Multiplication, Division, Block movement of Data, Finding Smallest number array, and Sorting. Interfacing Chips: Parallel I/O (8255) – Keyboard and Display controller (8279) – Timer/ Counter (8253) - Programmable Interrupt Controller (8259).

UNIT III MICROPROCESSOR APPLICATIONS - 8085 **10 hrs.**

8085 Microprocessor interfacing with simple control devices – Traffic light control – Stepper Motor control – Temperature and Humidity in Refrigeration & Air-Conditioning – Anti lock breaking - General Block diagram for Interfacing CNC machines.

UNIT IV 8051 MICROCONTROLLER **10 hrs.**

8051 Architecture: Microcontroller Hardware – I/O Pins, Ports – Internal and External memory – Counters and Timers – Serial data I/O – Interrupts – 8051 Assembly Language Programming: Addressing modes, Instruction set of 8051, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions interrupts and return interrupts and return interrupt handling.

UNIT V 8051 PROGRAMMING AND APPLICATIONS **10 hrs.**

Program format - Simple programs – Addition, Subtraction, Multiplication, Division, Finding Smallest number array, and Sorting.

8051 Interfacing with: LCD, Sensors, Stepper Motors, Keyboard, Pulse measurement, ADC and DAC.

TEXT / REFERENCE BOOKS:

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 4th Edition, Penram International Publishing, New Delhi, 2000.
2. Douglas V., Hall, Microprocessors and Interfacing, TMH, 2006.
3. Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, 2nd Edition, Penram International Publishers (India), New Delhi, 1996.
4. Mohammed Ali Mazidi and Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, New Delhi, 2003.
5. Rafi Quazzaman M., Microprocessors Theory and Applications: Intel and Motorola prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max.Marks: 80 Exam Duration: 3 Hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1014	DESIGN OF MACHINE ELEMENTS (Common to MECHANICAL and MECHANICAL & PRODUCTION)	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 10 hrs.

Introduction to the design process – Factors influencing machine design, selection of materials based on mechanical properties – Direct, bending and torsional stress equations – Impact and shock loading – Calculation of principle stresses for various load combinations, eccentric loading – Factor of safety – Theories of failure –Stress concentration – Design for variable fatigue loading – Soderberg, Goodman and Gerber relations

UNIT II DESIGN OF SHAFTS AND COUPLINGS 10 hrs.

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways – Design of rigid and flexible couplings – Design of knuckle joint and cotter joints

UNIT III DESIGN OF FASTNERS AND WELDED JOINTS 10 hrs.

Threaded fastners – Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures.

UNIT IV DESIGN OF SPRINGS 10 hrs.

Design of helical, leaf, belleville springs (disc) and torsional springs under constant loads and varying loads – Concentric springs

UNIT V DESIGN OF BEARINGS AND FLYWHEELS 10 hrs.

Design of bearings – Sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – Calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.

Note: *(Use of P S G Design Data Book is permitted in the University examination)*

TEXT / REFERENCES BOOKS:

1. Juvinall R.C., and Marshek K.M., "Fundamentals of Machine Component Design", Third Edition, John Wiley & Sons, 2002.
2. Bhandari V.B., "Design of Machine Elements", Tata McGraw-Hill Book Co, 2003.
3. Norton R.L., "Design of Machinery", Tata McGraw-Hill Book Co, 2004.
4. Orthwein W., "Machine Component Design", Jaico Publishing Co, 2003.
5. Ugural A.C., "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
6. Spotts M.F., Shoup T.E., "Design and Machine Elements" Pearson Education, 2004.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1015	GAS DYNAMICS AND JET PROPULSION	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I COMPRESSIBLE FLUID FLOW – FUNDAMENTALS **10 hrs.**

Introductory concepts of compressible flow, Energy and momentum equations for compressible fluid flows, various regions of flow, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical mach number, types of waves, mach cone, mach angle, effect of mach number on compressibility.

UNIT II FLOW THROUGH VARIABLE AREA DUCTS **10 hrs.**

Isentropic flow through variable area duct, T-S and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, Mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

UNIT III FLOW THROUGH CONSTANT AREA DUCTS **10 hrs.**

Flow in constant area duct with friction (Fanno Flow) – Fanno curves, and Fanno Flow equations, variation of flow properties, variation of Mach number with duct length. Flow in constant area duct with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equations, variation of flow properties, maximum heat transfer.

UNIT IV NORMAL SHOCK **10 hrs.**

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across normal shock. Normal shocks – stationary and moving, applications. Prandtl Meyer equation, impossibility of shock in sub-sonic flows, flow in convergent and divergent nozzles with shock, normal shock in Fanno and Rayleigh flows. Flow with oblique shock (elementary treatment only).

UNIT V PROPULSION **10 hrs.**

Aircraft propulsion – types of jet engines – energy flow through jet engines, study of turbo jet engine components – thrust, thrust power, propulsive and overall efficiencies, thrust augmentations in turbo jet engines, ram jet and pulse jet engines Rocket propulsion – Types of rocket engines – Liquid and solid fuel rocket engines – Introduction to Electrical and Nuclear rockets.

TEXT / REFERENCE BOOKS:

1. Yahya S.M.,"Fundamental of Compressible flow", New Age International (P) Ltd., New Delhi, 2003.
2. Cohen H., Rogers R.E.C. and Sravanamutoo, "Gas Turbine Theory", Addison Wesley Ltd., 2001
3. Hill D. and Peterson C., "Mechanics & Thermodynamics of Propulsion ", Addision Wesley, 1992.
4. Ganesan V., "Gas Turbines", Tata McGraw Hill Publishing Company, New Delhi. 1999.
5. Sutton G.P., "Rocket Propulsion Elements", John Wiley, New York, 1975.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1043	MANUFACTURING TECHNOLOGY - II	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I THEORIES OF METAL CUTTING **10 hrs.**

Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES **10 hrs.**

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, Bar feed mechanism.

UNIT III OTHER MACHINE TOOLS **10 hrs.**

Reciprocating machine tools: shaper, planer, slotter - Milling : types, milling cutters, operations - Hole making : drilling - Quill mechanism , Reaming, Boring, Tapping - Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING **10 hrs.**

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet machining - Gear cutting, forming, generation, shaping, hobbing.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING **10 hrs.**

Numerical control (NC) machine tools – CNC: types, constructional details, special features – design considerations of CNC machines for improving machining accuracy – structural members – slide ways – linear bearings – ball screws – spindle drives and feed drives. Part programming fundamentals – manual programming – computer assisted part programming.

TEXT / REFERENCE BOOKS:

1. Hajra Choudhary. S.K. and Hajra Choudhary A.K, "Elements of Manufacturing Technology, Vol II", 1st Edition, Media Publishers 1986.
2. RAO.P.N, "Manufacturing Technology, Metal cutting and Machine tools", 2nd Edition, TMH, 2007.
3. Chapman. W.A.J, "Workshop Technology Vol II", 5th Edition, Arnold Publishers, 2003.
4. Roy A. Lindberg, "Process and Material Manufacturers", 4th Edition, PHI, 1995.
5. Pabla B.S. and Adithan M., "CNC Machines", 1st Edition, New Age International, 2009.
6. H.M.T Production Technology Tata McGraw Hill, 2005.
7. Hastle Hurst M, Manufacturing Technology, 3rd Edition ELBS, 1998.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

Part B : **100% Theory** -
2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1016	POWER PLANT ENGINEERING	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I STEAM POWER PLANT **10 hrs.**

Plant layout, types of firing systems – pulverized fuel, tilting and tangential firing system, pulverized bed combustion system. Coal handling systems – crushers – feeders, ash handling system – dust collectors id and id fans – economizers, air preheaters, super-heaters, re-heaters.

UNIT II BOILER CALCULATIONS AND POWER CYCLES **10 hrs.**

Subcritical and supercritical boilers, boiler calculations – boiler efficiencies, equivalent evaporation, boiler power. Condensers – types – calculation of vacuum efficiency, cooling towers – tower characteristics. Review of Rankine cycle – reheat regeneration with open and closed types of feed water heaters and their representation in TS diagram.

UNIT III GAS TURBINE, NUCLEAR AND HYDEL POWER PLANTS **10 hrs.**

Gas turbine plants – open and closed cycles – construction details –, reheating regeneration and intercooling, combined cycle plants and their represention in TS diagram. Nuclear energy – fission – fusion reaction, nuclear fuel, enrichment, nuclear reactor – parts and types, waste disposal and safety in nuclear plants. Hydel plants – classification, selection of turbines, pumped storage system.

UNIT IV NON CONVENTIONAL ENERGY BASED POWER PLANT **10 hrs.**

Non conventional energy – various forms – capacity – availability and limitations. Solar energy plants – various collecting devices – solar devices, photovoltaic cells and solar ponds, wind mills – types – site selection – capacity estimation – performance evaluation, tidal power plants, fuel cells – working – types – limitations, performance evaluation.

UNIT V ECONOMIC AND ENVIRONMENTAL ASPECTS **10 hrs.**

Load curves, fixed and operating costs, economics of load sharing and plant selection, comparison of economics of various power plants and co-generation, environmental hazards of various power plants- CO_2 SO_x, NO_x and particulate emissions and their control, land and water pollution.

TEXT / REFERENCE BOOKS:

1. Nagpal G.R., Power Plant Engineering – Khanna Publishers, 1996.
2. Domkundwar, Power Plant Engineering – Dhanpat Rai & Sons, Delhi, 1988.
3. Vopal and Stortzki," Power Plant Engineering", PHI, 2007.
4. El Wakil M.N., "Power Plant Technology", McGraw Hill, 1985.
5. Joel Weisomon and Roy Eckart, "Modern Power Plant Engineering", PHI, 1985.
6. Rai G.D., "Non conventional sources of Energy", Khanna Publishers Delhi, 1994.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1044	MEASUREMENTS & METROLOGY (Common to Mech, Mech & Prod, Automobile)	L	T	P	Credits	Total Marks
		3	0	0	4	100

UNIT I CONCEPT OF MEASUREMENT **10 hrs.**

General concept- Methods of measurement- Generalised measurement system- Classification of instruments- Errors-systematic and random errors-correction, calibration-parameters associated with measurements like precision, accuracy, readability, span and range, hysteresis- sensors and transducers-mechanical and electrical type.

UNIT II MEASUREMENT OF POWER, PRESSURE, TEMPERATURE AND FLOW **10 hrs.**

Power, Force and Torque-mechanical, hydraulic, pneumatic and electrical type- Pressure- low pressure measurement using Mc Leod gauge, thermal conductivity gauge and ionization gauges-high pressure measurement using diaphragm gauges and bulk modulus pressure gauge. Temperature- thermo couple, RTD, thermistor and pyrometers.

Flow- Turbine type flowmeter, magnetic flowmeter, ultra sonic flow meter, thermal flowmeter and hot wire anemometer.

UNIT III LINEAR AND ANGULAR MEASUREMENT **10 hrs.**

Definition of Metrology - Linear measuring instruments: vernier, micrometer internal measurement, slip gauges and classification, interferometry, optical flats, introduction to limits, fits, tolerance and gauging, limit gauges- Comarators: mechanical, pneumatic, electrical and optical types, applications.

Angular measurements: sine bar, optical bevel protractor, angle decker- Taper measurements, Autocollimeter.

UNIT IV FORM MEASUREMENT **10 hrs.**

Measurement of screw threads- Terminology of screw threads, measurement of major and minor diameter, pitch, flank angle and effective diameter of screw threads, floating carriage micrometer- measurement of gears-tooth thickness-constant chord and base tangent method-Gleason and Parkson gear testing machines- Radius measurement-Surface finish, straightness, flatness and roundness measurements.

UNIT V LASER AND ADVANCES IN METROLOGY **10 hrs.**

Precision instruments based on laser principles- laser interferometer-application in linear and angular measurements and machine tool metrology – Coordinate measuring machine (CMM) – Constructional features- types, applications-digital devices-computer aided inspection.

TEXT / REFERENCES BOOKS:

1. Beckwith T.G. and Marangoni, “Mechanical Measurements”, Addison Wesley, 2000.
2. Jain R.K., “Engineering Metrology”, Khanna Publishers, 1994.
3. Alsutko, Jerry.D.Faulk, Thomson, “Industrial Instrumentation”, Asia Pvt Ltd., 1996
4. Sirohi, “Mechanical Measurements”, New Age Publications, 1991.
5. Gupta S.C., “Engineering Metrology”, Dhanpat Rai Publications, 1984.
6. Gaylor & Shotbolt, “Engineering Metrology”, Mc Donald & Co Publications, 2005.
7. Hume K.J., “Engineering Metrology”, ELBS, 1970.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SECX4014	ELECTRONICS & MICROPROCESSOR LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

ELECTRONICS LAB

1. Study of logic gates.
2. Half and Full adder/ Subtractors.
3. Grey code converter
4. Ripple Counters and Mod – N Counters.
5. Encoders and decoders.
6. Multiplexers & Demultiplexers.

MICROPROCESSOR AND MICROCONTROLLER LAB

Using Microprocessor - 8085

1. Programs based on Arithmetic operations
2. Programs based on sorting
3. Interfacing of stepper motor.
4. Interfacing ADC and DAC.
5. Interfacing Traffic light control.

Using Microcontroller - 8051

6. Programs based on Arithmetic operations
7. Programs based on sorting
8. Interfacing of stepper motor.
9. Interfacing Traffic light control

SPRX4006	METROLOGY LABORATORY	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Angle measurement using Sine bar
2. Angle measurement using Bevel Protractor.
3. Bore Measurement by two ball and four ball method
4. Testing Square ness of a Tri-square using Slip Gauges.
5. Measurement of dimensions with TMM
6. Measurement of gear tooth thickness
7. Gear profile checking using Profile projector
8. Composite error in gears using Parkinson Gear Tester
9. Measurement of surface finish.
10. Electronic Comparator
11. Straightness measurement using autocollimator

SPRX4015	MACHINE SHOP PRACTICE LAB – II (Special Machines)	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Shaping Machines : Machine of plane and inclined surfaces, grooving – V grooving, dovetail cutting.
2. Planing : Exercise involving plane and inclined surfaces.
3. Grinding : Exercise involving cylindrical grinding – Surface grinding – single point tool grinding in tool and cutter grinder.
4. Milling : Cutting of spur, helical, bevel gear, milling of polygon surface.
5. Boring : Simple exercise in boring machine.
6. Hobbing : Making of spur and helical gear.
7. Slotting : Key way cutting (internal & external).
8. Measurement of cutting forces in turning, milling and drilling : (tool dynamometer).

*Practices in Capstan and Turret lathes (at least one exercise)

*Unconventional machines : (Study)

Any of the following – Ultrasonic, EDM, ECM, Abrasive jet machining.

SMEX1017	RESOURCE MANAGEMENT TECHNIQUES (Common to All Branches)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION AND LINEAR PROGRAMMING **10 hrs.**

Operations Research(OR)-Nature-Characteristics-Phases.-Role of OR in Decision making- Outline of OR Models Linear Programming – Formulation of L.P.problems –Solution by graphical method, simplex method, and big M methods – Applications of O.R. in production management

UNIT II TRANSPORTATION AND ASSIGNMENT MODEL **10 hrs.**

Transportation problem – Initial Basic feasible solution- Northwest corner method, Least Cost method, Vogel's approximation method – Test for optimality-MODI method

Assignment problems- Hungarian assignment models- Travelling salesman problems

UNIT III RESOURCE SCHEDULING AND NETWORK ANALYSIS **10 hrs.**

Problem of Sequencing – Problem with N jobs and 2 machines N Jobs 3 m/cs and 2 Jobs m m/cs (Graphical method). Project Management – Basic concepts – Network construction and scheduling CPM & PERT Program evaluation and resource leveling by network techniques, time – Cost trade off.

UNIT IV INVENTORY CONTROL AND SIMULATION **10 hrs.**

Inventory Control – Various Types of inventory models – deterministic inventory models – Production model, Purchase model– with and without shortage- EOQ – Buffer stock – Shortage quantity, Probabilistic inventory models – Quantity Discount and Price Breaks Simulation – Use, advantages & limitations, Monte –Carlo simulation, application to queuing, inventory & other problems

UNIT V QUEUEING THEORY, GAME THEORY AND REPLACEMENT MODELS **10 hrs.**

Queuing theory – Poisson arrivals and exponential service times, Single channel models only. Game theory-Pay off matrix, competitive games with pure strategy, minimax criterion, principles of dominance &mixed strategies Replacement policy for items whose maintenance cost increases with time- Consideration of time value of money- Replacement policy- Individual, Group replacement of items that fail completely

TEXT / REFERENCE BOOKS:

1. Kanti Swarup, Gupta P.K., & Manmohan., "Operations Research", 12th Edition, S. Chand & Sons, 2007.
2. Mittal K.V., Optimization Methods in OR and System Analysis", New Age Publications, 2007.
3. Sharma S.D., "Operations Research", Kedarnath Ramnath & Co, 2002.
4. Hamdy A. Taha," Operations Research", 5th Edn., PHI, 1995
5. Hiller & Liberman,"Introduction to operation research", 5th Edn., McGraw Hill, 2001.
6. Ravindran, Phillips & Solberg, "Operations Research: Principles and practice", 2nd Edn., Wiley India Lts, 2007

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1018	HEAT AND MASS TRANSFER (Common to Mech and Aero)	L	T	P	Credits	Total Marks
		3	1	0	4	100

(Use of Heat transfer data book, steam table are permitted)

UNIT I CONDUCTION **10 hrs.**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems-critical thickness of insulation – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Infinite and Semi Infinite Solids

UNIT II CONVECTION **10 hrs.**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Forced Convection – External Flow – Flow over Plates, Cylinders Spheres and Bank of tubes – Internal Flow – Free Convection – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS **10 hrs.**

Nusselt's theory of condensation- Regimes of pool boiling and flow boiling, correlations in boiling and condensation. Heat Exchanger Types – Overall Heat Transfer Coefficient – Fouling Factors – Analysis – LMTD method, – NTU method.

UNIT IV RADIATION **10 hrs.**

Basic Concepts, Laws of Radiation – Wiens Displacement Law – Stefan Boltzman Law, Kirchoff Law – Black Body Radiation – Grey body radiation – Shape Factor – Electrical Analogy – Radiation Shields.

UNIT V MASS TRANSFER **10 hrs.**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

TEXT / REFERENCE BOOKS:

1. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata Mc Graw Hill, 2004
2. Rajput R.K.," Heat and Mass transfer", S.Chand & Co, 1983.
3. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
4. Kothandaraman C.P., "Fundamentals of Heat and Mass Transfer", New Age International (P) Ltd., 1998
5. Sachdeva R.C., "Fundamentals of Heat and Mass Transfer", New Age Internationals (P) Ltd., 2010
6. Ozisik N.M., "Heat Transfer", McGraw Hill Book Company, 1988.
7. Holman J.P., "Heat Transfer", McGraw Hill Book Company, 1989
8. Yadav R.," Heat and Mass Transfer", Central Publishing House, 1995.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1019	DESIGN OF TRANSMISSION SYSTEMS (Common to Mechanical – Mechanical and Production)	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 10 hrs.

Selection and design of – Flat belts and pulleys- V belts and pulleys –Chain drives and sprockets

UNIT II DESIGN OF SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 10 hrs.

Gear Terminology-Speed ratios – Selection and design of spur gear- material selection- service factor- module calculation for endurance strength- Force analysis -Tooth stresses (fillet bending stress and contact stress) — Parallel axis Helical Gears – Equivalent number of teeth-Forces. Estimating the size of the helical gears and stresses – Dynamic effects- Fatigue strength

UNIT III DESIGN OF BEVEL AND WORM GEARS 10 hrs.

Straight bevel gear: Tooth terminology- Design of pair of straight bevel gears – Tooth forces and stresses

Worm Gear: Merits and demerits- Terminology. Thermal capacity, Design of the worm and gear – Forces and stresses, efficiency

UNIT IV DESIGN OF GEAR BOXES 10 hrs.

Geometric progression – Standard step ratio – Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT V DESIGN OF CLUTCHES AND BRAKES 10 hrs.

Design of plate clutches – Axial clutches-Cone clutches-Internal expanding rim clutches –Design of brakes – Internal and external shoe brakes.

Note: (*Usage of P.S.G Design Data Book is permitted in the University examination*)

TEXT / REFERENCES BOOKS:

1. Juvinall R.C., K.M. Marshek , “Fundamentals of Machine component Design”, Third Edition, John Wiley & Sons, 2002.
2. Bhandari V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.
3. Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw-Hill, 1985.
4. Shigley J.E. and Mischke C.R., “Mechanical Engineering Design”, McGraw-Hill International Editions, 1989.
5. Norton R.L., “Design of Machinery”, McGraw-Hill Book co, 2004.
6. Hamrock B.J., Jacobson B., Schmid S.R., “Fundamentals of Machine Elements”, McGraw-Hill Book Co., 1999.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1020	MECHATRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I MECHATRONICS, SENSORS AND ACTUATORS **10 hrs.**

Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Sensors and actuators – Performance Terminology – Sensors for Displacement, Position and Proximity-selection. Directional Control Valves – Rotary Actuators, Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives. Electrical Actuation Systems – Mechanical Switches – Solid State Switches of Sensors

UNIT II RELAYS AND LADDER DIAGRAMS **10 hrs.**

Relays –electromechanical –reed-solid state. Ladder diagrams – sequence charts-ladder diagram design using sequence charts – Huffman method -through cascade method – single path sequencing, multi path sequencing system. Primitive flow table – row merging and merged flow table-state assignment.

UNIT III SYSTEM MODELS AND CONTROLLERS **10 hrs.**

Building blocks of Mechanical, Fluid and Thermal Systems, Rotational –Translational Systems, Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode –Step mode –Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – DigitalControllers – Micro Processors Control.

UNIT IV PROGRAMMING LOGIC CONTROLLERS **10 hrs.**

Programmable Logic Controllers (PLC) – Basic Structure – Input / Output modules – Selection of PLC programming – Mnemonics – Timers, Internal relays and counters – Shift Registers –Master and Jump Controls – Data Handling – Analogs Input / Output – Simple example of PLC applications.

UNIT V DESIGN OF MECHATRONICS SYSTEM **10 hrs.**

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design – Case studies of Mechatronics systems- Pick and place Robot- time delay using PLC, autonomous mobile robot- – Engine Management system- Automatic car park barrier- automatic camera.

TEXT / REFERENCE BOOKS:

1. Bolton W., "Mechatronics", 2nd Edition, Pearson education, 5th Indian Reprint, 2003.
2. Smaili A., and Mrad F., "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.
3. Rajput R.K., "A Textbook of Mechatronics", S. Chand & Co, 2007
4. David. W. Pessen," Induatrial Automation, Circuit Design and Components", John Wiley, 1990
5. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2000.
6. Bradley D.A., Dawson D., Buru N.C., and Loader A.J., "Mechatronics", Chapman and Hall, 1993.
7. Dan Necsulesu, "Mechatronics", Pearson Education Asia, (Indian Reprint), 2002

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX4009	DYNAMICS LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Longitudinal vibration of spring mass system.
2. Undamped free vibration of equivalent spring mass system.
3. Undamped torsional vibration of single rotor system.
4. Critical speed of whirling shafts.
5. Amplitude and frequency of forced vibration using vibration exciter and vibration meter.
6. Static and dynamic balancing of rotating masses.
7. Characteristics of Governors – WATT's, Porter and Proell.
8. Gyroscopic torque measurement.
9. Drawing profile of the cam.
10. Velocity ratio of epicyclic gear train.

SMEX4010	MECHATRONICS LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

1. Design and testing of fluid power circuits to control
   (i) velocity (ii) direction and (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic and Pneumatic circuits using software
4. Circuits with multiple cylinder sequences in Electro pneumatic using Programmable Logic Controllers(PLC)
5. Proportional Integral Derivative(PID) controller interfacing
6. Stepper motor interfacing with 8051 Micro controller (i) full step resolution (ii) half step resolution
7. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW software
8. Computerized data logging system with control for process variables like pressure flow and temperature.

SMEX4011	THERMAL ENGINEERING LAB – I	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Performance test on reciprocating air compressor
2. Performance test on air blower
3. Determination of C.O.P of vapour compression refrigeration system.
4. Test on Air-Conditioning system
5. Test on wind tunnel
6. Determination of flash and fire point using pensky martin apparatus.
7. Determination of viscosity of liquid using saybolt viscometer
8. Determination of viscosity of liquid using redwood viscometer
9. Calorific value of liquid fuel.
10. Calorific value of gaseous fuel.
11. Study of boiler.

SMEX1021	TOTAL QUALITY MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES **10 hrs.**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection,Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) **10 hrs.**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS **10 hrs.**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS **10 hrs.**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

TEXT / REFERENCE BOOKS:

1. Dale H.Besterfiled, et. al., Total Quality Management, Pearson Education Asia, 1999. (Indian reprint 2002).
2. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002
3. Feigenbaum A.V., "Total Quality Management, McGraw-Hill, 1991.
4. Oakland J.S. "Total Quality Management Butterworth – Hcinemann Ltd., Oxford. 1989.
5. Narayana V. and Sreenivasan N.S., Quality Management – Concepts and Tasks, New Age International 1996.
6. Zeiri. "Total Quality Management for Engineers Wood Head Publishers, 1991.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1022	FLUID POWER SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I GENERAL INTRODUCTION **10 hrs.**

Introduction to fluid power – review of fundamental principles of fluid power – construction, operation and characteristics of gear pump, vane pump, variable displacement pump, piston pump. Fluid power actuators, linear and rotary – computation of force – flow requirement – cushioning – cylinder mountings – relative merits – selection criteria for specific applications – power pack design

UNIT II CONTROL SYSTEM COMPONENTS AND ACCESSORIES **10 hrs.**

Valves – non return valve for pressure control, direction control and flow control – servo valves and proportional control valves – valve actuation techniques – pressure, electrical and limit switches, Relief valve – brake valve – counter balance valve. Fluid power maintenance – filters – seals – reservoirs, selection of accumulators, hoses and couplings. Safety regulations as per BIS

UNIT III HYDRAULIC SYSTEMS **10 hrs.**

Fluid power symbols, hydraulic Circuits – regenerative – intensifier – metering out – bleed off. Design of circuits for specific applications – vehicle suspension systems – hydraulic press – low cost automation. Programmable logic control. Electrical control for FPCs. Temperature control in hydraulic circuits.

UNIT IV HYDRAULIC CIRCUIT **10 hrs.**

circuits and selection of components with specification for the following applications – hydraulic or pneumatic systems for shapers – lift – hydraulic press – automatic reciprocating system – hydraulic cranes and earth moving equipments.

UNIT V PNEUMATIC SYSTEMS **10 hrs.**

Basic principles of pneumatic circuits – merits and demerits over hydraulic systems, pneumatic conditioners – filters – regulators – lubricators – mufflers – air dryers. Types of Air compressors – pneumatic actuators – control of pneumatic circuits – valves. Introduction to pneumatic logic control – pneumatic hydraulic circuits.

TEXT / REFERENCE BOOKS:

1. Anthony Esposito, Fluid Power with Applications – Prentice Hall, 1980
2. Prinches M.J., and Ashby John, Power Hydraulics, Prentice Hall, 1980
3. Sullivan James P., Fluid Power Theory and Applications, Prentice Hall, 1989
4. James L Johnson, Introduction to Fluid power, Cengage Delmark Learning Edition, 2009.
5. Srinivasan, Hydraulis and Pneumatics, Tata McGraw Hill, 2nd Edition, 2001
6. Shanthakumar S.R., Fluid power system, Anuradha Publications, 1996.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SAUX1025	AUTOMOBILE ENGINEERING (Common to VII Sem Mech and Prod-Elective subject)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO AUTOMOBILES **10 hrs.**

Chassis: Different types of chassis and their construction, Chassis dimensions. Frames-Types- Engine: Classification-various components- construction- Eg. Car, MUV, LCU, HGP, Bus, army, Construction

Auto emission: Pollution from the automobile, Emission Control Systems – Construction and Operation of PCV Systems, Evaporative Emission Control, Heated Air Intake System, EGR Systems, Catalytic Converters- emission testing- Emission standard of vehicle in India, Euro norms

UNIT II CLUTCHES & POWER TRANSMISSION **10 hrs.**

Requirement of Clutches – Principle of Friction Clutch – Wet Type & Dry Types; Cone Clutch, Single Plate Clutch, Diaphragm Spring Clutch, Multi plate Clutch, Centrifugal Clutches, Electromagnetic Clutch, Over Running Clutch, Clutch Linkages. Maintenance aspects- Fluid coupling- Torque convertor.

Requirements & Arrangement of Power Transmission system, Objective of the Gear Box, types-Sliding Mesh-Constant Mesh- Synchro mesh-Epi cyclic- Overdrive-Maintenance aspects.

UNIT III STEERING SYSTEM, WHEEL & TYRE **10 hrs.**

Wheel geometry & alignment -Conditions for true rolling motions of Wheels during steering, Types of steering mechanism- Steering linkages and layout-Power steering, Electronic steering system.

Types of Wheels -Wheel Balancing. Types & constructional details of tyres-Types of Tyre wear & their causes, Front & rear axle- stub axle-types.

UNIT IV AUTOMOTIVE BRAKES & SUSPENSIONS **10 hrs.**

Classification of Brakes-Drum Brakes-Disc Brakes; Brake actuating systems; Mechanical, Hydraulic, Pneumatic Brakes; Factors affecting Brake performance, Power & Power Assisted Brakes, ABS.

Need for Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring-leaf springs-torsion bar-shock absorbers- Air suspensions.

UNIT V FUEL FEED SYSTEM, ALTERNATE FUEL & ELECTRICAL SYSTEM **10 hrs.**

CNG, LPG and Hydrogen in Automobiles as fuels, Electric and Hybrid vehicles, Fuel Cells – Safety.

Carburetor-solex-Turbocharging-Fuel injection system-common rail – CRDI - MPFI-Ignition System-Magneto and Battery ignition- Ignition timing-Dynamo-alternator- starter motor - Head lamp-reflectors-Gauges-fuel, temperature & oil, wipers, Automobile air conditioning.

TEXT / REFERENCE BOOKS:

1. Kirpal Singh, Vol I & II, Automobile Engineering, standard Publishers Distributors, 1998.
2. Crouse/Anglin, Automotive Mechanics, TMH, 1992.
3. Ganesan V., Advance IC Engine, TMH, 2001.
4. Sethi H.M., Automotive Technology, TMH, New Delhi, 2003.
5. Joseph Heitner, Automotive Mechanics, EWP, 2003.
6. Anthony Schwaller E., Motor Automotive Technology – Delmer Publishers, Inc, 2004.
7. Newton, Steeds & Garrett, The Motor Vehicle – 2nd Edition, Butter Worths, 2010.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1045	PRODUCTION PLANNING AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I PRINCIPLES OF PPC **10 hrs.**

Introduction to PPC- Objectives and benefits of PPC – Organization for PPC -Factory planning – Production Systems – Job, Batch And Mass production – Elements of Product development and design – marketing, functional and operational aspects. Durability and dependability – standardization, specialization and simplification.

UNIT II SALES FORECASTING **10 hrs.**

Sales forecasting – needs and benefits – types of forecasting – trend analysis – regression lines and correlation analysis – effect of forecasting on production order – accuracy of forecast – plant capacity and machine capacity – EOQ.

UNIT III PREPLANNING **10 hrs.**

Production planning – process planning – economics of new design – value analysis, material layout planning – case studies – elements of MRP and Inventory Control – Selective control systems – ABC analysis – inventory control parameters.

UNIT IV PRODUCTION PLANNING **10 hrs.**

Aggregate planning – machine balancing – routing, scheduling and loading - information required and documentation – Process planning layout, route cards - priority scheduling – forward and backward scheduling – master production schedules.

UNIT V PRODUCTION CONTROL **10 hrs.**

Phases of production control – principles and documents for dispatching, expediting and follow up – progress report – Gantt charts and SchedU graphs – Japanese techniques of production control – JIT system – kanban – system and procedures for PP & C, application of computers in PP & C

REFERENCE BOOKS

1. Jain & Agarwal, Production Planning and Industrial Management, 2007.
2. Buffa E.S., Modern Production Management – John Wiley, 1971.
3. Narasimhan et al, Production Planning and Inventory Control – PHI., 1992
4. Samual Eilon, "Elements of Production planning and Control", Mac Millan 1970
5. Stephen N, Chapman, "Fundamentals of Productions Planning and Control", Pearson Edition, India 2006

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX4012	THERMAL ENGINEERING LAB – II	L	T	P	Credits	Total Marks
		0	0	2	1	50

INTERNAL COMBUSTION ENGINES

1. Valve timing diagram of a four stroke engine, Port timing diagram of a two stroke engine.
2. Performance test on a multi cylinder diesel engine.
3. Mechanical efficiency using negative horse power method.
4. Mechanical efficiency using retardation test.
5. Performance test on a four stroke diesel engine.
6. Heat balance test on a multi-cylinder diesel engine.
7. Optimum speed for engine fuel consumption
8. Performance characteristics of a two stroke petrol engine.
9. Performance characteristics of a four stroke multi-cylinder petrol engine.
10. Determination of indicated power of multicylinder petrol engine- Morse test.

HEAT TRANSFER

1. Thermal conductivity of insulating material.
2. Thermal conductivity by guarded hot plate method.
3. Heat transfer through composite walls.
4. Heat transfer by free and forced convection.
5. Heat exchanger test – parallel flow and counter flow.
6. Emissivity measurement apparatus.
7. Heat transfer from fins – natural and forced convection.
8. Stefan – Boltzman apparatus.

SMEX4013	CAD LAB III	L	T	P	Credits	Total Marks
		0	0	2	1	50

Description: Assembly modeling teaches you how to maximize your use of the assembly modeling capabilities

3D MODELING

Use of any one popular modeling software – Part modeling done for the exercises: Screw jack, Cotter with Sleeve joint, Knuckle joint, Universal coupling, etc.

ASSEMBLING

Top-Down Assembly Modeling – Stages in the Process, Building Virtual Parts – Building Parts in an Assembly, Assembly Features, Advanced Mate Techniques – Adding Mate References – Design Library Parts – Assembly Editing – Mirroring Components – Hole Alignment – Controlling Dimensions in an Assembly

DRAWINGS AND DETAILING

Drawing sheets and views, Dimensions, Annotations, Bill of materials and Tables.

SBAX1001	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I MANAGEMENT FUNCTIONS & STRUCTURE **10 hrs.**

Management – Definition – Basic Function – Contribution of Taylor & Fayol. Types of structure – Line, staff, Functional, Committee, Project & Matrix – Structures.

Departmentalization – Centralization – Decentralization – span of control. Management By Objectives – Management By Exception.

UNIT II MANAGEMENT OF ORGINASATION **10 hrs.**

Forms of Business / Industrial Ownership – Sole Trader, Partnership, Company, Performance Appraisal – Basic Principles – Pitfalls – Methods to Overcome. Industrial Safety – Causes of Accidents – Cost of Accident – How to minimize Accidents. Plant Layout & Maintenance – Need, Types & Managerial Aspects.

UNIT III ORGANISATIONAL BEHAVIOUR **10 hrs.**

OB – Definition – Nature & Scope – Contributing Disciplines – Importance of OB to Managers. Personality – Definition – Theories – Factors Influencing Personality. Motivation – Definition – Theories. Theory X & Y – Transactional Analysis. Morale & Job Satisfaction – Factors Influencing Job Satisfaction.

UNIT IV GROUP DYNAMICS **10 hrs.**

Group – Definition – Types – Determinants of Group Cohesiveness – Communication – Process – Barriers – Effective Communication. Leadership Theories – Factors Contributing to Effective Leadership – Role of Trade Union in Organizations – Functions of Trade Union – Why Trade Union is required? – Types of Trade Union.

UNIT V PROFESSIONAL ETHICS **10 hrs.**

Ethics in Workplace – Formulation of Ethics – Managerial Ethics – Managing Ethical Behaviour – Codes of Ethics – Encouraging Ethical Behaviour – Social Responsibility – Spirituality.

TEXT / REFERENCE BOOKS

1. Gupta C.B., Management Theory and Practice, 14th Edition, Sultan Chand & Sons, 2009.
2. Prasad L.M., Principle & Practice of Management, 7th Edition, Sultan Chand & Sons, 2008.
3. Aswathappa, Organisational Behaviour, 8th Edition, Himalaya Publishing House, 2010.
4. Dr. Prasad L.M., Organisational Behaviour, 4th Edition, Sultan Chand & Sons, 2008.
5. Harold Koontz, Principles of Management, 1st Edition, Tata McGraw Hill, 2004.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1046	MODERN MANUFACTURING PROCESSES	L	T	P	Credits	Total Marks
		3	0	0	4	100

UNIT I MECHANICAL PROCESSES **10 hrs.**

Ultrasonic Machining- Elements of process, cutting tool system design, effect of parameters, economic considerations, applications, limitations of the process, advantages and disadvantages. Abrasive Jet Machining- Variables in AJM, metal removal rate in AJM. Water Jet Machining- Jet cutting equipments, process details, advantages and applications.

UNIT II ELECTROCHEMICAL AND CHEMICAL METAL REMOVAL PROCESSES **10 hrs.**

Electrochemical Machining- Elements of ECM process, tool work gap, chemistry of the process, metal removal rate, accuracy, surface finish and other work material characteristics, economics, advantages, applications, limitations. Electrochemical Grinding – Material removal, surface finish, accuracy, advantages, applications.

UNIT III THERMAL METAL REMOVAL PROCESSES **10 hrs.**

Electric Discharge Machining (EDM) or spark erosion machining processes, mechanism of metal removal, spark erosion generators, electrode feed control, dielectric fluids, flushing, electrodes for spark erosion, selection of electrode material, tool electrode design, surface finish, machining accuracy, machine tool selection, applications. Wire cut EDM. Laser beam machining (LBM) - Apparatus, material removal, cutting speed and accuracy of cut, metallurgical effects, advantages and limitations.

UNIT IV PLASMA ARC MACHINING (PAM) **10 hrs.**

Plasma, non thermal generation of plasma, mechanism of metal removal, PAM parameters, equipments for D.C. plasma torch unit, safety precautions, economics, other applications of plasma jets. Electron Beam Machining (EBM) – Generation and control of electron beam, theory of electron beam machining, process capabilities and limitations.

UNIT V FMS AND CIMS **10 hrs.**

Introduction to Concurrent Engineering and Agile Manufacturing, Flexible manufacturing systems (FMS); FMS work stations; FMS planning and applications. Computer integrated manufacturing systems (CIMS); net work and data bases for manufacturing system. Simulation of Manufacturing systems.

TEXT / REFERENCE BOOKS:

1. Pandey P.C., Shan H.S., Modern Machining Processes – Tata McGraw Hill, 1980.
2. Ghosh and Malik, Machining Science Affiliated East-West Press, 2002.
3. Jain V.K., Unconventional Machining, 2004.
4. Benedict G.F. & Marcel Dekker Non Traditional Manufacturing Processes, 1987.
5. McGeongh Chapman J.A. and Hall - Advanced Methods of Machining, Kulwer Acadamic Publishers Group, 1988.
6. Gunsekaran A., Agile Manufacturing, Elsevier, 2001.
7. Hartely J.R., Cambridge M.A., Concurrent Engineering by Productivity by Press, 1992.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1023	WIND AND SOLAR ENERGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I WIND ENERGY **10 hrs.**

Introduction : Scope of wind power potential in India. Principles of wind energy conversion – Natural power in the wind – Forces on blades. Wind data and energy estimation , site selection. Wind energy conversion system – Classification : Advantages and disadvantages.

UNIT II WIND MACHINES **10 hrs.**

Types of wind machines, analysis of aerodynamic forces acting on blade, performance, generating systems, energy storage – Applications.

UNIT III SOLAR ENERGY **10 hrs.**

Solar radiation and its measurement – Solar constants , solar radiation at earth surface, spectral distribution of extra terrestrial radiation, variations of basic earth sun angles, solar time and equation of time, diffused radiation – Empirical equations – Computation of radiation on inclined surfaces – Solar charts.

UNIT IV SOLAR COLLECTORS **10 hrs.**

Measurement of diffused , global and direct solar radiation, solar collectors – Flat plates and parabolic collectors and comparison of collectors, selective absorber coatings.

UNIT V SOLAR ENERGY STORAGE AND APPLICATION **10 hrs.**

Solar energy storage systems, solar pond, thermo electric conversion, solar photovoltaic, solar heating and cooling, industrial process heat, desalination.

REFERENCE BOOKS:

1. Rai G.D., Non Conventional Sources of energy,. Khanna publications, 4th Edn., 1999.
2. Garg H.P. and Prakash J., Solar energy, Fundamentals and application, 2006.
3. David M.Eggleston and Stoddard S., Wind turbine Engineering designing, – Van Noustrand, 1987.
4. Putnam, C Palmer, Power from wind., Van Noustrand, 1984.
5. Le Couriers D., Wind power plants. Theory and design, Permagon press, 1982.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX4011	DESIGN OF JIGS, FIXTURES and PRESS TOOLS LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

(Use of approved handbook is allowed for practical exam)

INTRODUCTION OF JIGS AND FIXTURES

Typical work holding - chucks, mandrels & vices & indexing table – Principle of jigs & fixtures-Locating devices-Indexing devices-Clamping devices- Actuators - Pneumatic hydraulic-Design calculation of clamping devices

DESIGN & DRAWING OF JIGS

Types of jigs – Drawing of Drill jigs –Box jigs –Indexing jig - Channel jig., etc.

DESIGN & DRAWING OF FIXTURES

Design & Drawing of Milling fixtures – Turning fixtures – Planning & Shaping fixtures-Assembling fixtures-Broaching fixtures –Grinding fixtures-Welding fixtures

DESIGN & DRAWING OF PRESS TOOLS

Design of Simple, Progressive and Compound dies-Design of bending die- Design of drawing die-Basic principle of Design of moulds for plastics

REFERENCE BOOKS:

1. Goroshkin, A.K., Jigs & Fixtures, Handbook, Mir Publications, Moscow, 1979.
2. Korsakov, Fundamental of Fixture Design, Mir Publications, Moscow, 1989.
3. ASTME, Handbook of Fixture Design, McGraw Hill, Newyork, 1962.
4. Kempster, Introduction to Tool Design & Jigs & Fixtures, ELBS, 2003.
5. Donaldson C. and others, Tool Design, Tata McGraw Hill of India Pvt, Ltd., 1978.
6. Design Data, Compiled by Faculty of Mech, Engg, P.S.G. Tech., Paper Back Publication, 2005
7. Elanchezain .C, Sunder Selwyin.T and Vijaya Ramnath.B"Design of Jigs ,Fixtures and Press Tools, Eswar Press, 2003

SPRX4014	CAM SIMULATION LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

INTRODUCTION:

Application of NC manual part programming, Computer assisted part programming, NC part programming using CAD software.

(a) CNC Milling:

(i) Part Programming for:

1. Point to point motions.
2. Linear motions.
3. Circular interpolations (both CW & CCW).
4. Contour motions.
5. Pocket milling.
6. Rectangular milling.
7. Circular milling.
8. Mirroring Commands.

(ii) Part Programming involving fixed or canned cycles:

1. Drilling.
2. Peck drilling.
3. Boring.
4. Tapping.

(iii) Part programming using

1. Do loops.
2. Sub Routines.

(b). CNC Lathe:

(i) Part programming for:

1. Turning.
2. Facing.
3. Chamfering.
4. Grooving.
5. Step Turning.
6. Taper Turning.
7. Circular Interpolation.

(ii) Part programming using standard fixed cycles:

1. Turning
2. Facing
3. Taper Turning
4. Grooving of Threads Cuttings

S15XPROJ	PROJECT WORK AND VIVA VOCE	L	T	P	Credits	Total Marks
		0	0	30	15	100

The objective of the project work is to make use of the knowledge gained by the student at various stages of the degree course. Students, will also be permitted to undertake industrial/consultancy project Work, outside the department, in industries/Research labs. There shall be three assessments during the semester by a review committee. The student shall make three presentations on the progress made before the committee at various stages of the Project work. The Head of the Department shall constitute the review committee for each branch of study. The total marks obtained in the three reviews, shall be taken in to account. There will be a viva – voce examination at the end of the Project work, conducted by one internal examiner and one external examiner. The total marks secured will be the sum of marks secured in the Project reviews and Viva Voce Examination. Each student is required to submit a Project report on the project assigned to him by the department. The report should be based on the information available in the literature or data obtained by the student by way of experiments conducted in the laboratory/industry.

SMEX1024	ADVANCED INTERNAL COMBUSTION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I THERMODYNAMICS OF DIESEL CYCLE 10 hrs.

Thermodynamics of Diesel Cycle – Performance of 4 and 2 stroke engines – use of gaseous, liquid and solid fuels – composition of petrol and diesel fuels – combustion fuels – principles of spark and compression ignition – theoretical and actual air / fuel ratio, importance valve and port timing.

UNIT II COMBUSTION 10 hrs.

Octane and Cetane number determination – carburetion – carburettor – diesel fuel pump and injection system – normal and abnormal combustion – effects and prevention in diesel and petrol engines, shape of combustion chambers in SI and CI engines – air movement in CI engines – charge stratification in SI engines.

UNIT III COOLING, LUBRICATION AND IGNITION SYSTEMS 10 hrs.

Engine cooling and lubrication systems, spark ignition system – inlet and exhaust manifold arrangements – ideal, relative, mechanical and thermal efficiency, brake mean effective pressure and heat balance calculation and curves, torque, load – speed characteristics of multicylinder engines

UNIT IV DESIGN OF ENGINE COMPONENTS 10 hrs.

Simple Component design of piston, cylinder, connecting rod, crankshaft, flywheel and main bearing – Functions of inlet and exhaust valves, cylinder heads, piston rings, cylinder liners, air filters, exhaust silencers, petrol fuel pump, lube oil pump, cam shaft.

UNIT V APPLICATIONS 10 hrs.

Applications: Diesel engine in different fields – Automobile, Agriculture, Marine, industrial power plants and rail traction, petrol engine for automobile. Comparison of diesel, steam and gas turbines power plants. Fuel oil reserves and saving methods – alternate fuel and bifuel operation in engines – free piston engines and wankel rotary engines.

REFERENCE BOOKS:

1. John Heywood, Internal Combustion engines, McGraw Hill, 1988
2. Gill, Smith and Zurich, Fundamentals of IC Engines, 2011
3. Mathur R.B. and Sharma R.P., Internal Combustion Engines, Dhanpat Rai and Sons, 1994
4. Ganesan V., Internal Combustion Engines, TMH 1996
5. Kothandaraman C.P. et al., A course in Thermodynamics in Heat Engines Dhanpat Rai and Sons, 2002
6. Heldt P.M., High Speed Combustion Engines, Oxford and IBH, 2008
7. Internal Combustion Engines, Maleev.V.L, McGraw Hill, 2010

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1025	CRYOGENIC ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Introduction: Cryogenic Engineering – Properties of cryogenic fluids – Oxygen, Nitrogen, Argon, Neon Flourine, Helium. Hydrogen, Properties of Solids – Mechanical, Thermal, and Electrical-Super conductivity.

UNIT II CRYOGENIC REFRIGERATION **10 hrs.**

Cryogenic refrigeration: Principle – Joule Thomson Expansion, Cascade processes, Ortho para hydrogen conversion, cold gas refrigerators, Linde-Hampson cycles, Claude and cascaded systems, magnetic cooling, Stirling Cylce Cryocoders.

UNIT III CRYOGENIC REQUIREMENTS **10 hrs.**

Cryogenic requirements: Cryogenics- Heat Exchangers, Compressors, Expanders, Effect of various parameters in performance and system optimization. Insulation and Storage equipments for cryogenic fluids, industrial storage and transfer of cryogenic fluids

UNIT IV GAS SEPARATION AND PURIFICATION **10 hrs.**

Gas Separation and purification: Ideal gas, Mixture characteristics – composition diagrams – gas separation – Principle of Rectification, Flash Calculation Rectification column analysis – air separation, gas purification.

UNIT V CRYOGENIC INSTRUMENTATION: **10 hrs.**

Cryogenic Instrumentation: Properties and characteristics of instrumentation, Strain Displacement, Pressure, flow, Liquid level, Density and temperature measurement in cryogenic range.

REFERENCE BOOKS :

1. Randal F. Barron, Cryogenic Systems, Mc Graw Hill, 1985
2. Scoot, Cryogenic Engineering, Van Nostrand Co. Inc. 1985.
3. T.M Flynn, Cryogenic Engineering, Maxwell Dekker, 1997.
4. Klaus D. Timmerhaus, Richard Palmer Reed, Cryogenic Engineering: 50 years of progress, Springer, 2007.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1026	REFRIGERATION AND AIR CONDITIONING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I REFRIGERATION CYCLES & REFRIGERANTS **10 hrs.**

Vapour Compression Refrigeration Cycle-Simple saturated vapour compression Refrigeration cycle. Thermodynamic analysis of the above. Refrigerant Classification, Designation, Alternate Refrigerants, Global Warming Potential & Ozone Depleting Potential aspects.

UNIT II SYSTEM COMPONENTS **10 hrs.**

Refrigerant Compressors – Reciprocating Open & Hermetic type, Screw Compressors and Scroll Compressors -Construction and Operation characteristics. Evaporators – DX coil, Flooded type Chillers. – Expansion devices -Automatic Expansion Valves, Capillary Tube & Thermostatic Expansion Valves – Condensing Units and Cooling Towers.

UNIT III CYCLING CONTROLS AND SYSTEM BALANCING **10 hrs.**

Pressure and Temperature controls. Range and Differential settings – Selection and balancing of system components – Graphical method.

UNIT IV PSYCHROMETRY **10 hrs.**

Moist air behaviour, Psychrometric chart, Different Psychrometric process analysis.

UNIT V AIR CONDITIONING **10 hrs.**

Summer and Winter Airconditioning, Cooling Load Calculations, Air Distribution Patterns, Dynamic and Frictional Losses in Air Ducts, Equal Friction Method, Fan Characteristics in Duct Systems.

REFERENCE BOOKS

1. Stocker W F and Jones J W, “Refrigeration & Air Conditioning” McGraw Hill Book Company, 1985.
2. Dossat R J, “Principles of Refrigeration”, John Wiley and Sons Inc., 1997.
3. Manohar Prasad, “Refrigeration and Air Conditioning ”, Wiley Eastern Ltd., 2007.
4. Arora C P, “Refrigeration and Air Conditioning ”, Tata McGraw Hill, 2000.
5. Jones W P, “Air Conditioning Engineering”, Elsevier Butterworthy- Heine Mann, 2005.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1027	COMBUSTION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I COMBUSTION OF FUELS **10 hrs.**

Combustion equations, Theoretical air, excess air, air fuel ratio, equivalence ratio, exhaust gas composition, Airfuel ratio from exhaust gas composition, heating value of fuels.

UNIT II THERMODYNAMICS OF COMBUSTION **10 hrs.**

Thermo-chemistry, First law analysis of reacting systems, Adiabatic combustion temperature, Second law analysis of reacting systems, criterion for chemical equilibrium, Equilibrium constant for gaseous mixtures, Evaluation of equilibrium composition, chemical availability

UNIT III KINETICS OF COMBUSTION **10 hrs.**

Rates of reaction, Reaction order and molecularity complex reactions, chain reactions, Arrhenius rate equation, Collection theory, activated complex theory, Explosive and general oxidative characteristics of fuels

UNIT IV FLAMES **10 hrs.**

Laminar and Turbulent flames, Premixed and Diffusion flames, Burning velocity and its determination, Factors affecting burning velocity, Quenching, Flammability and Ignition, Flame stabilization in open burners.

UNIT V ENGINE COMBUSTION **10 hrs.**

Combustion in SI and CI engines, stages of combustion in SI and CI engines, Normal combustion and Abnormal combustion, Emissions from premixed combustion, Emission from Non-premixed combustion, Control of emissions

REFERENCE BOOKS

1. Stephen R. Turns, “An Introduction to Combustion”, McGraw Hill Book Company, 1996.
2. Irwin Glassman, “Combustion”, Third Edition, Academic Press, 1996.
3. Sharma S.P. and Chandramohan, “Fuels and Combustion”, Tata McGraw Hill Book Co., 1984.
4. Samir Sarkar, “Fuels and Combustion”, Orient Longman, 1984.
5. Kuo K.K., “Principles of Combustion”, John Wiley & Sons, 1984.
6. Heywood J.B., “Internal Combustion Engine Fundamentals”, Mc Graw Hill Book Co., 1988.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80 Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1031	DESIGN OF HEAT TRANSFER EQUIPMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION 10 hrs.

Double pipe heat exchangers and heat pipes: Heat pipes – structures – applications – basic relations – performance characteristics – effects of working fluid and operating temperature, wick – selection of material – pore size.

UNIT II SHELL AND TUBE HEAT EXCHANGERS 10 hrs.

Shell and tube Heat Exchangers: Basic components – shell – tube bundles – baffles – types and geometry, Design procedure – preliminary estimation of size, pressure drop and heat transfer calculations – shell and tube sides – Kern methods – Bell – Delaware method.

UNIT III COMPACT HEAT EXCHANGERS AND GASKETTED PLATE HEAT EXCHANGERS 10 hrs.

Compact Heat Exchangers and Gasketted plate Heat Exchangers: Compact heat Exchangers – types – constructional features, heat transfer and pressure drop calculation – finned plate and tube. Gasketted – plate exchangers – constructional features – plate pack and frame – operation characteristic – flow arrangement heat transfer and pressure drop calculation, performance analysis, comparison with other type of heat exchangers.

UNIT IV CONDENSERS AND EVAPORATORS 10 hrs.

Condensers and Evaporators: Shell and tube condensers – horizontal and vertical type – design and operation consideration, plate condensers, air cooled and direct contact types, condenser for refrigeration, evaporative condensers. Evaporators for refrigeration and air conditioning – chillers – air coolers – thermal analysis – Shah, Kandhakar and Ghngor & Wintertom correlations, std types

UNIT V COOLING TOWERS 10 hrs.

Cooling Towers: Cooling towers-types – basic relations – heat balance &heat transfer – characteristic, effect of packing – geometry, spray design, selection of pumps, fans, testing, maintenance, environmental effect wind loads, typical installations.

REFERENCE BOOKS

1. Sadik Kakac & Hongtan Lin, Heat Exchangers – CRC Press, London, 1998
2. Arthur P Fraas, Heat Exchanger, Design – John Wiley & Sons, 1997
3. Kern D., Process Heat transfer – Tata MC Graw Hill, 1997
4. Walker, Industrial Heat Exhchangers – MC Graw Hill, 1997
5. Holger Martin, Heat Exchangers – Hemisphere publishing Corporation, London, 1992

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1034	SOLID WASTE MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I SOLID WASTE **10 hrs.**

Definitions – Sources, Types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste

UNIT II WASTE TREATMENT **10 hrs.**

Size Reduction – Aerobic Composting – Incineration – Furnace Type & Design, Medical/ Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT III WASTE DISPOSAL **10 hrs.**

Land Fill Method of Solid Waste Disposal – Land Fill Classficaition, Types, Methods &Siting Consideration – Layout & Preliminary Design of Land Fills – Composition, Characteristics generation, Movement and Control of Landfill Leachate & Gases – Environmental Monitoring System for Land Fill Gases, Waste landfill Remediation

UNIT IV HAZARDOUS WASTE MANAGEMENT **10 hrs.**

Definition & Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling -Assessment of Hazardous Waste Sites – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure, Remediaiton, risk assessment.

UNIT V ENERGY GENERATION FROM WASTE **10 hrs.**

Thermal conversion Technologies – Pyrolysis systems, Combustion systems, Gasification systems, Environment control systems, energy recovery systems.

Biological & chemical conversion technologies – Aerobic composting, low solids. Anaerobic digestion, high solids anaerobic digestion, Energy production from biological conversion products, other biological transformation processes. Chemical transformation processes.

REFERENCE BOOKS:

1. George Tchobanoglous, H.Theisen, S. Vigil, Integrated Solid Waste management- Engg. Principles and management issues – McGraw Hill, 1993.
2. Parker, Colin, & Roberts, Energy from Waste – An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985
3. Shah, L Kanti., Basics of Solid & Hazardous Waste Management Technology, Prentice Hall,
4. Manoj Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House, 1997
5. Rich, Gerald et.al., Hazardous Waste Management Technology, Podvan Publishers, 1987
6. Bhide AD., Sundaresan BB, Solid Waste Management in Developing Countries, INSDOC New Delhi, 1983.

WEBSITES:

1. www.bical.net
2. www.volund.dk
3. www.iswa.org
4. www.wmrc.uiuc.edu

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1032	VIBRATION AND NOISE CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I SINGLE AND TWO DEGREES OF FREEDOM VIBRATIONS **10 hrs.**

Single and two degrees of freedom vibrations: Review of single degree of freedom systems – free, damped and forced vibrations – Linear and Torsional vibrations, seismometer, accelerometer. Two degrees of freedom systems – Vibration absorbers – Undamped and Damped- Vibration isolation.

UNIT II MULTIPLE DEGREE FREEDOM VIBRATIONS **10 hrs.**

Multi degree Freedom vibrations: Multi degree vibration systems – free vibration – close coupled and far coupled systems – Eigen Value Problem – Orthogonality of mode shapes, modal analysis, forced vibration and numerical methods – Dunkerley, Raleigh and Holzer methods

UNIT III BALANCING **10 hrs.**

Balancing: Rotor Balancing methods – Rigid and flexible rotor balancing – Analytical development – Application to balancing- Advantages and limitations of modal balancing- Influence coefficient balancing, analytical development balancing – Procedure – Advantages and limitations of unified balancing approach – Analytical development – Balancing procedure – Experimental comparison of various methods

UNIT IV VIBRATION MONITORING **10 hrs.**

Vibration Monitoring: Experimental Methods in vibration analysis – Vibration exciters, measurement devices, analyzers, condition exciters, measurement devices, condition based maintenance of machines and economics – Applications- Vibration monitoring and analysis – Case studies.

UNIT V NOISE CONTROL **10 hrs.**

Noise Control: Sound wave characteristics- levels and decibels – Directivity, source of noise, estimation of noise source and acoustics of walls- Enclosure barrier, sound absorbing materials, duct noise and mufflers.

REFERENCE BOOKS :

1. Rao J.S., & Gupta K., Theory & practice of Mechanical vibrations – John Wiley, 1999.
2. Ashok Kumar Malik, Principles of vibration control, – Affiliated East West press, 1993.
3. Timsohenko S,. Young D.H. & Weaver W. Vibration problems in engineering. Fourth Edition.- John Wesley & Sons, New York 1967.
4. Grover G.K., Mechanical Vibrations – Nemchand Bros., Roorkers(U.P) 1989.
5. Mark S. Darlow, Balancing of High Speed Machinery- Springer Verlog, 1992.
6. Kewal K. Rujara, Vibrations and noise for Dhanpat Rai & Sons, 1987.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1033	INDUSTRIAL TRIBOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

(Approved hand book may be used in the Examination)

UNIT I FRICTION **10 hrs.**

Dry Friction: Dry Friction – Topography of Surfaces – Contact between surfaces – Sliding friction – Energy dissipation – Theory of molecular attraction – Fretting corrosion and prevention – Variables in dry friction – Present concept of friction – Boundary Friction – Oiliness – Variables of boundary friction – Friction characteristics of metals and non metals – Rolling friction – Sources of measurement of friction

UNIT II WEAR **10 hrs.**

Wear: Wear – Types – Mechanisms – Factors affecting wear – Adhesive wear, fatigue wear, corrosive wear and brittle fracture wear – Delamination – Wear measurement

UNIT III VISCOSITY AND FLOW **10 hrs.**

Viscosity and Flow: Fundamentals of viscosity and flow – Petroff's equation – Friction torque – Viscosity measurement, factors affecting viscosity, Principle of Hydrostatic lubrication – Hydrostatic step bearing – Multi-recess bearing – Design Problems – Different types of compensation and their effect on bearing parameters – Hydrostatic lift, simple problems – Hydrostatic squeeze films.

UNIT IV HYDRODYNAMIC LUBRICATION **10 hrs.**

Hydrodynamic lubrication: Solution of Reynold's Equation – Application to tilt pad thrust bearing – Design of hydrodynamic journal bearings – Force feed of oil flow with various types of grooves – Brief discussion on Dynamic bearing and rotor systems and Elastohydrodynamic lubrication – Brief discussion.

UNIT V LUBRICANTS AND MAINTENANCE **10 hrs.**

Lubricants and Maintenance: Lubricants – Types – Solid and liquid – Properties – Additives – Testing – Reclamation of lubricants – surface treatment – Phosphating of metal surface, Teflon Coating – Predictive maintenance – Signature analysis and Condition monitoring – Basic Principles – Instrumentation

REFERENCE BOOKS:

1. Hutchings M., Tribology, Friction and wear of Engineering Materials – Edward Arnold, London, 1992
2. Ncalc, Newncs, Tribology Hand Book Butterworths, 1975
3. Dudley D. Fuller, Theory and practice of Lubrication for Engineers – John Wiley and Sons, 1984.
4. Camaron A. Basic Lubrication Theory – Wiley Eastern Ltd, 1987
5. Majundar, Introduction of Tribology and bearings – A.H. Wheeler Co. 1986
6. Bharath Bushsan & Gupta B.K., Hand book of Tribology – Mc Graw Hill Inc., 1991

UNIVERSITY EXAM QUESTION PAPER PATTERN:

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1036	EXPERIMENTAL STRESS ANALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I STRESS **10 hrs.**

Stress at a point – Stress equations of Equilibrium – Laws of stress transformation – Principal stresses – Maximum Shear stress – Dimensional state of stress.

UNIT II STRAIN MEASUREMENT **10 hrs.**

Strain – Its relations to experimental determination – Properties of strain gauge systems – Electrical resistance strain gauges – Strain gauge circuits – Recording instruments – Analysis of strain gauge data.

UNIT III MOIRE METHODS **10 hrs.**

Mechanism of formation of Moire fringe – Geometrical approach to Moire fringe analysis – Displacement field approach to Moire fringe analysis – Out of plane measurements.

UNIT IV PHOTOELASTICITY METHODS **10 hrs.**

Temporary double refraction – Stress optic law – Effects of stressed model in a plane polariscope fringe multiplication – Isochromatic fringe patterns – Isoclinic fringe pattern- Compensation techniques – Calibration methods – Separation methods – Scaling model to phototype stresses – Materials

UNIT 5 BRITTLE COATING TECHNIQUE **10 hrs.**

Coating stresses and strains – Sensitivity – Materials and applications – Effect of thickness – Stress separation.

REFERENCE BOOKS:

1. Dove Adams, Experimental Stress Analysis, McGraw Hill, 1992.
2. James Dalley, W.F.Riley, " Experimental mechanics ", int. Student Edition McGraw Hill, Kogakusha Ltd., 1992.
3. Perry and Lissiener, " Strain Gauge Primer ", McGraw Hill, 1965.
4. Durelli, Photomechanics Prentice Hall, 1972.
5. Holister. G.S, "Experimental Stress Analysis", 1987

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1039	FINITE ELEMENT ANALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I 1D FINITE ELEMENT ANALYSIS **10 hrs.**

Historical Background – Weighted Residual Methods – Basic Concepts of FEM – Variational Formulation of B.V.P – Ritz Method – Finite Element Modeling – Element Equations – Linear and Quadratic Shape functions -Bar, Beam Elements – Applications to Heat Transfer.

UNIT II FEA OF 2D PROBLEMS **10 hrs.**

Basic Boundary Value Problems in 2 Dimentions – Triangular, quadrilateral, higher order elements – Poissons and Laplace Equations – Weak Formulation – Elements Matrices and Vectors – Application to Solid mechanics, Heat transfer, Fluid Mechanics.

UNIT III ISO PARAMETRIC FORMULATION **10 hrs.**

Natural Co-ordinate System – Lagrangian Interpolation Polynomials – Iso-parametric Elements – Formulation – Numerical Intergration – 1D -2D Triangular elements – rectangular elements – Illustrative Examples.

UNIT IV SOLUTION TO PLANE ELASTICITY PROBLEMS **10 hrs.**

Introduction to Theory of Elasticity – Plane Stress – Plane Strain and Axisymmetric Formulation – Principle of virtual work – Element matrices using energy approach.

UNIT V SPECIAL TOPICS **10 hrs.**

Dynamic Analysis – Equation of Motion – Mass Matrices – Free Vibration analysis – Natural frequencies of Longitudinal – Transverse and torsional vibration – Introduction to transient field problems. Non linear analysis. Use of software – h & p elements – special element formulation.

REFERENCE BOOKS:

1. Reddy J.N. “An Introduction to the Finite Element Method” , Mc Graw Hill, International Edition, 1993.
2. Segerlind L.J., “Applied Finite Element Analysis”, John Wiley, 1984.
3. Rao S.S., “Finite Element Method in Engineering” , Pergamon Press, 1989.
4. Chandrupatla & Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.
5. Cook, Robert Davis et al, “Concepts and Applications of Finite Element Analysis” , Wiley, John & Sons,1999.
6. George R Buchanan, “Schaum’s Outline of Finite Element Analysis”, McGraw Hill Company, 1994.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1038	COMPUTATIONAL FLUID DYNAMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I GOVERNING DIFFERENTIAL EQUATIONS **10 hrs.**

Conservation of chemical species -the energy equation – Momentum equation -Time -Averaged equations for Turbulent flow – Turbulence -Kinetic -Energy Equations -The General Differential Equation -Nature of Coordinates-Independent variables-Choice of Co-ordinates-One way and Two-way Co-ordinates.

UNIT II DISCRETIZATION METHODS **10 hrs.**

Nature of numerical methods – Methods of Deriving the Discretization Equations – Taylor Series formulation – variational formulation-Method of weighted residuals -Control volume –Formulation.

UNIT III HEAT CONDUCTION, CONVECTION AND DIFFUSION **10 hrs.**

Steady state one-dimensional conduction – two and three dimensional conduction -Steady state one-dimensional convection and Diffusion – Discretization equations for two dimensional convection and diffusion.

UNIT IV CALCULATION OF FLOW FIELD **10 hrs.**

Representation of the pressure.- Gradient term and continuity equation – Staggered grid – Momentum equations -Pressure and velocity corrections – Pressure. – Correction equation. Introduction to Finite Element method -Solution of Steady state heat conduction by FEM – incompressible flow -Simulation by FEM.

UNIT V TURBULENCE MODELS – ALGEBRAIC MODELS **10 hrs.**

One equation Model – Two equation models – High and Low Reynolds number models – Reynolds stress models – Prediction of fluid flow and heat Transfer using Standard codes.

REFERENCE BOOKS:

1. Muralidhar K., and Sundarajan T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 1995.
2. Ghoshdastidar P.S., “Computer Simulation of flow and heat transfer”, Tata McGraw Hill Publishing Company Ltd., 1998.
3. Fletcher C.A.J., “Computational Techniques for Fluid Dynamics “1” Fundamental and General Techniques, Springer-Verlag, 1987.
4. Fletcher C.A.J., “Computational Techniques for Fluid Dynamics” 2” Specific Techniques Different Flow Categories, Springer-Verlag, 1987.
5. Bose T.K., “Numerical Fluid Dynamics”, Narosa publishing House, 1997.
6. Muralidhar K., and Biswas “Advanced Engineering Fluid Mechanics”, Narosa Publishing House, New Delhi, 1996.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1029	NON DESTRUCTIVE TESTING AND TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I PRINCIPLES AND IMPORTANCE OF NDT **10 hrs.**

Basic concepts of NDT-Its principles and significance in boiler and pressure vessel manufacturing- Case study – Types of structures and defects for analysis-Code requirements-Quality control and inspection procedures in industrial practice

UNIT II BASIC CRACK DETECTION METHODS **10 hrs.**

Dye penetrant testing-Materials and specifications-Developers-Testing Procedure-Process capability and accuracy-Principles of magnetic particle testing- Types of equipment-Materials- Testing procedure-Process capability and accuracy.

UNIT III RADIOGRAPHIC TESTING **10 hrs.**

Production of X-rays-Types of radiation-Interaction of X-rays with matter-Absorption of X-rays-Gamma rays-Sources of gamma rays- X-rays- Radioactive decay-Artificial radio activity-Image formation-Sharpness and contrast and effects of various factors on them-Quality of film-Use of penetrometer and metal intensifying screens-Study and interpretation of radiographs-Safety precautions.

UNIT IV ULTRASONIC TESTING **10 hrs.**

Production of sound waves- Use of Transducers-Types of wave motion-Types of probes-Transmission and reflection techniques-Detection and interpretation of different types of defects-Thickness measurement.

UNIT V OTHER METHODS OF NDT **10 hrs.**

Eddy current testing-Principles and procedures-Instruments used and interpretation of readings-Acoustic emission testing-Principles and procedures-Instruments used and interpretation of readings-Non-industrial and other applications of NDT.

RERERENCE BOOKS

1. Barry Hull and Venon John, Non-Destructive Testing, ELBS, 1998.
2. Knud Boving, Non-Destructive Testing Handbook-Jaico Publications, 1998.
3. Metals Handbook-Volume 11, Non-Destructive Testing, ASME 1976.
4. Silk M.G., NDT Ultrasonic Transducers- Br. Institute of NDT, 1982.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1037	DESIGN FOR MANUFACTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I DFMN APPROACH AND PROCESS **10 hrs.**

Methodologies and tools- Design axioms- Design for assembly and evaluation- Minimum part assessment by taquchi method, robustness assessment- Manufacturing process rules- Designer's tool kit, Computer Aided group process rules – Computer Aided group Technology, failure mode effective analysis- Value Analysis- Design for minimum number of parts- Development of modular design, minimising part variations- Design of parts to be multi-functional, multi-use and ease of fabrication- Poka Yoka principles.

UNIT II GEOMETRIC ANALYSIS **10 hrs.**

Process capability- Feature tolerance, geometric tolerance, surface finish, review of relations between attainable tolerence grades and difference machining processes- Analysis of tapers and screw threads- Applying probability to tolerences.

UNIT III FORM DESIGN OF CASTINGS AND WELDMENTS **10 hrs.**

Redesign of castings based on parting line considerations- Minimizing core requirements- Redesigning cast members using weldments- Use of welding symbols.

UNIT IV MECHANICAL ASSEMBLY **10 hrs.**

Selective assembly- Deciding the number of groups- Control of axial play- Examples- Grouped datum systems -Different types- Geometric analysis and applications-Design features to facilitate automated assembly.

UNIT V TRUE POSITION THEORY **10 hrs.**

Virtual size concept- Floating and fixed fasteners, projected tolerance zone- Assembly with gasket- Zero true position tolerance-, Functional gauges- Paper layout gauging- Examples. Operation sequence for typical shaft type of components- Preparation of process drawings for different operations- Tolerance- Worksheets and centrality analysis- Examples.

REFERENCE BOOKS:

1. Harry Peck, "Designing for Manufacture", Pitman Publications, 1983.
2. Matousek, "Engineering Design - A Systematic Approach", Blackie & Son Ltd., London, 1974.
3. Sports M.F., "Dimensioning and Tolerance for Quantity Production", Prentice Hall Inc., 1983.
4. Oliver R. Wade, "Tolerance Control in Design and Manufacturing", Industrial Press Inc. New York Publications, 1967
5. James G. Bralla, "Hand Book of Product Design for Manufacturing", McGraw Hill Publications,1983.
6. Trucks H.E., "Design for Economic Production", Society of Manufacturing Engineers, michigan,2nd edition, 1987.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1040	INDUSTRIAL HANDLING & STORAGE SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I PRINCIPLES OF MATERIAL HANDLING **10 hrs.**

Importance and scope – Planning, Operation and costing principles- Types systems – Factors influencing their choice – Analysis of the handling systems – Motion analysis, flow analysis, safety analysis and cost analysis.

UNIT II INTERPLANT MATERIAL TRANSPORTING AND HANDLING EQUIPMENT **10 hrs.**

Interplant transporting facilities – Trucks, rail sliding , hoists, cranes, and other material handling equipment at receiving yard – Principles of palletisation – Bulk materials handling.

UNIT III INTERPLANT MATERIAL HANDLING EQUIPMENT **10 hrs.**

Handling within stores – Within production area – Aisle design – Fork lift trucks, types and applications – Automated materials handling – Jib carnes – OHT cranes – Safety requirements.

UNIT IV CONVEYORS **10 hrs.**

Conveyors, general theory and principles – several types of conveyors for bulk materials and unit loads – Belt – Apron, flight conveyors, bucket and swing tray conveyors – Car and platform conveyors – Screw Conveyors , Roller conveyors – Portable conveyors and their uses – Hydraulic and Pneumatic Conveyors – Overhead conveyors – Monorails – safety requirements.

UNIT V STORAGE SYSTEMS **10 hrs.**

Stores – planning and design – Storage systems and procedures – incoming material control – Stock location – Different types and arrangement of storage racks – Order picking – Loading and shipping – Stores accounting and stock verification – Automated storage and retrieval systems.

REFERENCE BOOKS:

1. John R. Immer, Material Handling, McGraw Hill. 1986
2. Dougals M. Considine, Standard Handbook of Industrial Automation, Champamn & Hall, 1994
3. James Mac Gregon Apple, Plant Layout and Material Handling, John wiley, 1991.
4. James Mac Gregon Apple, Material Handling System Design, Ronald Press, 1963.
5. Rudenko N., Material Handling Equipment, Peace Publishers, 1965.
6. Aleksandr Onisinovich Spivakovskii, Converyors and Related Equipments, Peace Publishers, 1992.
7. Aggarwal G.K., Materials Handling Equipment, Tata McGraw Hill Publication, 1983

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1041	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Intelligence – Definition, Types, Cognitive Aspect Approach; Measuring Intelligence – Early Efforts, Iq And Ai; Aspects Of Intelligence – Learning, Problem Solving, Creativity, Behaviour And Biology. Artificial Intelligence; Historical Background; Application Of Ai; Objection And Myths. AI Languages; Introduction To Prolog & Lisp.

UNIT II COGNITIVE PSYCHOLOGY **10 hrs.**

The Mind – Information And Cybernetics, Components For Thought; Modes Of Perception – Visual, Auditory And Other System; Memory Mechanism; Problem Solving – Planning, Search, The Gps System; Types Of Learning – Rote, Parameter, Method And Concept; Game Playing Reasoning.

UNIT III KNOWLEDGE ENGINEERING **10 hrs.**

Introduction; Role Of Knowledge Engineer; Knowledge Representation – Psychology, Production Rules, Logic And Programming, Common Sense And Fuzzy Logic; Semantic Network; Learning System.

UNIT IV VISUAL PERCEPTION **10 hrs.**

Introduction; Biology Of Vision; Computational Aspects; Towards Artificial Vision – Picture Processing – Identifying Real Objects; Vision Programmes; Factory Vision Systems, Robotics; Ai Impact; Robot Sensor; Factory Robots, Personal Robots; Robots Tomorrow.

UNIT V EXPERT SYSTEM **10 hrs.**

Introduction; Knowledge Acquisition For Expert System; Future of Expert System – System Structusystem Structure, Inference Engines, Uncertainties, Memory Mechanisms Range Of Application; Actural Aspect System – VP Expert. Assignment, Development of Simple Expert System.

REFERENCE BOOKS:

1. Rich E., Artificial Intelligence, Mcgraw Hill, 2002
2. Simons G.L., Introducing Artificial Intelligence, NCC publications, 1984
3. Charniak E. and Mc Dermott D., Introduction to Artificial Intelligence, 4th Edition, Pearson Education Inc. and Dorling Kindersley Publishing Inc, 2009
4. Jackson J.P., Introduction to expert systems, 3rd Edition, Addison Wesley Ltd, 1999.
5. Wendy B. Ranch Hindlin, AI in business, science and Industry Applications., Vol 2., PH, 1985

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX 1019	INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION AND ROBOTIC KINEMATICS **10 hrs.**

Definition need and scope of industrial robots-Robot anatomy-work volume-Precision movement-End effectors-sensors. Robot kinematics-Direct and inverse kinematics-Robot trajectories-Control of robot manipulators-Robot dynamics-Methods for orientation and location of objects.

UNIT II ROBOT DRIVES AND CONTROL **10 hrs.**

Controlling the robot motion-Position and velocity sensing devices-Design of drive systems-Hydraulic and Pneumatic drives-Linear and rotary actuators and control valves-Electro hydraulic servo valves, electric drives-Motors-designing of end effectors-Vacuum, magnetic and air operated grippers

UNIT III ROBOT SENSORS **10 hrs.**

Transducers and sensors-Sensors in robot-Tactile sensor-Proximity and range sensors-Sensing joint forces-Robotic vision system-Image Gripping-Image processing and analysis-Image segmentation-Pattern recognition-Training of vision system

UNIT IV ROBOT CELL DESIGN AND APPLICATION **10 hrs.**

Robot work cell design and control-Safety in Robotics-Robot cell layouts-Multiple robots and machine interference-Robot cycle time analysis-Industrial applications of robots

UNIT V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS **10 hrs.**

Methods of robot programming-characteristics of task level languages lead through programming methods- Motion interpolation. Artificial intelligence-Basics-Goals of artificial Intelligence-AI techniques-problems representation in AI-Problem reduction and solution techniques-Application of AI and KBES in robots.

TEXT / REFERENCE BOOKS:

1. Fu K.S., Gonzalez R.C. and Lee C.S.G., Robotics control,Sensing,Vision and intelligence", McGraw Hill, 1987
2. Kozyrey, Yu, "Industrial Robotics", MIR Publishers Moscow,1985.
3. Richard D., Klafter, Thomas A., Chmielewski, Machine Negin "Robotics Engineering-An Intergrated Approach", Prentice Hall of India Pvt., Ltd., 1984
4. Deb S.R., "Robotics Technology and Flexible Automation", Tata McGraw Hill,1994
5. Mikell P., Groover, Mitchell Weis, Roger, Nagel N., Nicholas Odrey" Industrial Robotics Technology,Programming and Applications", McGraw Hill, Int.,1986
6. Timothy Jordonides, et al., "Expert Systems and Robotics",Springer-Verlag, NewYork, May 1991.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX 1021	POWDER METALLURGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I POWDER PREPARATION **10 hrs.**

Manufacture - Chemical and Physical - Chemical methods - Mechanical methods - Production and properties of iron, Copper, tungsten, molybdenum, titanium, zirconium, tantalum, niobium, beryllium, aluminium, lead, tin, and alloy powders.

UNIT II POWDER COMPACTION **10 hrs.**

Pressureless forming - Loose sintering, slip casting, slurry casting, cold pressure forming - Pressing in metal dies - Vibratory compacting - Cyclic compacting - Powder rolling - Iso-static pressing explosive forming - Forming with binders - Hot Pressing.

UNIT III TOOLING **10 hrs.**

Tooling principles - Presses - Tool Construction - Component design consideration.

UNIT IV SINTERING **10 hrs.**

Principles of sintering – Porosity - Influence of particular size, shape, applied pressure, method of application of pressure - Effect of temperature, volume, physical and chemical effect of gases and vapours - Sintering forces - Shrinkage - Nature of sintered boundary liquid phase sintering - Sintering furnaces and atmospheres.

UNIT V ENGINEERING COMPONENTS **10 hrs.**

Tool materials - Cemented carbides - Oxide and boride cutting tools - Friction and anti-friction material applications.

TEXT / REFERENCE BOOKS:

1. Sands H.L and Shakespeare C.R., Powder Metallurgy Practice and Applications, George Newness Ltd., London, 1996
2. Sinha A.K., Powder Metallurgy, Dhanpat Rai, 1982
3. Jones W.D., Principles of Powder Metallugy, Edward Arnold and Co., 1939
4. Hausnor, Friction and Anti-Friction Materials, 1970.
5. G.S. Upathaya, "Powder Metallurgy Technology" Cambridge Inb science Publications, 1997

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX 1022	SIX SIGMA METHODS AND APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Quality Perception; Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement.

Descriptive statistics: Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis.

Probability Distribution: Normal, Binomial, Poisson Distribution

UNIT II BASICS & CONCEPTS **10 hrs.**

Basics of Six Sigma: Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X'S, Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score, Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

UNIT III METHODOLOGIES **10 hrs.**

Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

UNIT IV MEASUREMENT SYSTEM ANALYSIS AND DESIGN OF EXPERIMENTS **10 hrs.**

Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

UNIT V INTRODUCTION TO SOFTWARES FOR SIX SIGMA **10 hrs.**

Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to softwares for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

TEXT / REFERENCE BOOKS:

1. Geoff Tennant, Six Sigma: SPC and TQM in manufacturing and service, Gower Publishing Co.
2. Greg Brue, Six Sigma for managers, TMH, 2002
3. Pete Pande, What is Six Sigma, TMH, 2002
4. Peter S. Pande, The Six Sigma Way, TMH Team Field book, 2008

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1024	SYSTEM SIMULATION AND MODELING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I SYSTEM AND MODELING FUNDAMENTALS 10 hrs.

System – Basic concepts - Hierarchy - Types – Elements of a system – System description, modeling – Definition – Functions – Classification – Structure of simulation models – Modeling approaches, system simulation – Definition – The simulation process – Advantages.

UNIT II GENERATION OF RANDOM NUMBERS 10 hrs.

System behavior – simulation of random phenomena,- Monte-Carlo sampling, Random number generation – Mid square method – Mid product method – Multiplicative congruential method – Addditive congruential method, Testing for randomness – Chi –Square method – Kolmogrov – Smirnov method – Runs test – Gap test.

UNIT III DATA PREPARATION AND MODEL BUILDING 10 hrs.

Data preparation – Correlation and regression analysis , Curve fitting – Fitting of known distributions –Uniform - Normal – Exponential – Poisson – Weibull – Emperical Distribution Building, modeling in computer, - Language selection – Time flow mechanism – Flow diagram.

UNIT IV SIMPLE SIMULATION MODELS 10 hrs.

Simulation of a discrete system, Simulation of an event occurrence using random number table, Simulation of component failure using exponential and Weibull models, Simulation of single server and two servers queue, Simulation of an inventory system.

Planning of simulation experiments – tactical planning – Run length determination - Validation of simulation models – Analysis of simulation results.

UNIT V SIMULATION LANGUAGES 10 hrs.

Simulation languages – Introduction, GPSS, concepts – Advantages – Case example, SIMSCRIPT – Basic concepts – Advantages – Case example.

TEXT / REFERENCE BOOKS

1. Narasingh Deo, System Simulation with Digital Computers, PHI, 1979.
2. Geofery Gorden, System Simulation, PHI, 1995.
3. Jerry Banks, John S.Carson And Bary L. Nelson, Discrete Event System Simulation - Prentice Hall of India, 1996.
4. Robert E. Shanon, Systems Simulation, The Art and science, Prentice Hall Inc., New Jersy, 1973.
5. Wyman, Forrest Paul, Simulation Modeling : A Guide in using Simscript New York, John Willey & Sons, Inc., 1970.
6. Thomas J. Schriber, Simulation Using GPSS, John Willey &Sons , New York, 1974.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

Out of 20 marks, maximum of 10% problems may be asked. 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX 1025	SUPPLY CHAIN MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I SCM BASICS AND STRATEGIC FRAME WORK **10 hrs.**

Introduction – Business Environment- Origin of Supply Chain Management (SCM) – Understanding the Supply Chain- Basic concepts & Terminology- Importance of Supply chain- Supply chain strategies-Achieving strategic fit-Expanding strategic scope- Supply Chain Drivers - Drivers of Supply chain performance-Framework for structuring Drivers-inventory-transportation-facilities-Information.

UNIT II PLANNING DEMAND AND SUPPLY **10 hrs.**

Role of Demand Forecasting –Characteristics of Forecasts-Components of Forecast and Forecasting Methods-Measures of forecast error-Aggregate planning- Managing supply –Managing Demand-Implementing solutions

UNIT III PURCHASING & SUPPLY CHAIN **10 hrs.**

Purchase System- Factors affecting purchase function – Organizing the purchase function Purchasing Procedures-Negotiation. JIT and Quick Response logistics -Vendor Managed Inventory -Customer and Supplier Relationship concepts.

UNIT IV APPLICATION OF INFORMATION TECHNOLOGY IN SUPPLY CHAIN **10 hrs.**

Importance- Uses-IT as Supply Chain Enabler- Logistics information Systems –Supply Chain information Technology in practice-Software packages like BANN etc., E-Commerce – Role of E-business on Supply Chain.

UNIT V CO-ORDINATION IN A SUPPLY CHAIN **10 hrs.**

Lack of supply chain coordination – Bullwhip effect- Effect of lack of coordination- Managerial Levers to achieve Coordination-Building strategic partnership-Achieving Coordination in practice.

TEXT / REFERENCE BOOKS:

1. Sunil Chopra, Peter Meindl., Supply Chain Management Strategy, Planning, and Operation, Pearson Education Asia, 2007
2. Hanfield, Rrobert., Introduction to Supply Chain Management, Prentice Hall, 1999
3. Lysons. K., Purchasing and Supply Chain Management, PHI, 2005
4. Martin Christopher, Logistics and Supply chain Management, Pitman Publishing, 2005
5. Monczka, Trent & Handfield., Purchasing and Supply chain Management, Thomson south western, 2002
6. Gopalakrishnan.P, Sundaresan Materials Management, An Integrated Approach, PHI, 2002

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1028	NON-TRADITIONAL MACHINING TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Principles of non-traditional machining techniques-Classification based on energy source-Transfer media and Mechanism- Water jet machining, Abrasive jet machining, Abrasive flow machining-Equipment- applications.

UNIT II ULTRASONIC MACHINING **10 hrs.**

Ultrasonic Machining - Process principle-Equipment-power supply-Transducer-Tool headers, tools, abrasives-Process parameters, capabilities and applications.

Ultrasonic welding- Process principle-Equipment-power supply-Transducer-Coupling and clamping systems-Power clamping force, Welding time, frequency- applications.

UNIT III ELECTROCHEMICAL MACHINING **10 hrs.**

Chemical Machining and Electrochemical Machining -Process principle-Equipment-Electrolytes-ECM tools-Process parameters, capabilities and applications-Electrochemical grinding and electrochemical discharge grinding-principle-Equipment-Process parameters, capabilities and applications.

UNIT IV ELECTRICAL DISCHARGE MACHINING **10 hrs.**

Electrical discharge machining- Process principle-Equipment-power supply-Dielectric system-Electrodes-Servo system- Electrical discharge wire cutting-Process principles-Equipment-Power supply-Positioning system-Servo drive system-Power supply-Dielectric system

UNIT V OTHER MACHINING PROCESSES **10 hrs.**

Electron beam Machining- principle -Equipment-Electron beam gun-Power supply-Machining systems- capabilities and applications.

Laser Processing-Process principles-Equipment-Solid state lasers, gas lasers-Applications-Drilling, cutting, marking, welding, heat treating and cladding - Plasma arc machining- Equipment and applications - Ion beam machining - principle -Equipment- capabilities and applications.

TEXT / REFERENCE BOOKS:

1. Pandey and Shah, Modern Machining Processes, Tata McGraw Hill, 1990
2. Gary Benedict, Non-Traditional Manufacturing Processes, Marcel Dsekker, 1987.
3. ASTME, Non-traditional Machining Processes, USA.
4. HMT, Production Technology, Tata McGraw Hill, 1971.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SPRX1029	SPECIAL CASTING PROCESSES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Introduction to sand casting - Conventional mould and Core making - Need for special casting process -applications.

UNIT II SHELL MOULDING **10 hrs.**

Process - Machines - Pattern - Sand, resin and other materials - Process parameters charateristics of shell mould castings - 'D' Process - Applications.

UNIT III INVESTMENT CASTING **10 hrs.**

Process - Pattern and mould materials - Block mould and ceramic shell mould - Mercast and shaw process -Applications.

UNIT IV CENTRIFUGAL CASTING **10 hrs.**

Types of Cetrifugal processes - calculation of rotating speed of the mould - Equipment - Application.

UNIT V CONTINOUS CASTING (CO_2) SAND PROCESS AND FULL MOULD PROCESSES **10 hrs.**

Reciprocating Continuous mould process - Direct chill process - Use of Steel, Aluminium, Brass material in continuous casting. CO_2 mould / Core hardening process - principles Full mould process - Applications. Other special process like squeeze casting and electro slag casting processes.

TEXT / REFERENCE BOOKS:

1. Jain P.L., "Foundry Technology", Tata McGraw Hill, 1992.
2. Higgins R.A., "Engineering Metallurgy", Viva Books Pvt Ltd., 1994.
3. Heine Lpoer, "Principle of Metal Casting", McGraw Hill, 1999
4. Gupta. R.B., "Foundary Engineering" Sathya Prakasham, New Delhi, 1989
5. ASM Metals Handbook on Casting, 1992.
6. Banga T.R. and Agarwal. RL, "Foundary Engineering", Khanna Publishers, 1992

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks: 80 Exam Duration: 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SAUX 1016	ALTERNATE FUELS & ENERGY SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION **10 hrs.**

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

UNIT II ALCOHOLS **10 hrs.**

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS **10 hrs.**

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

UNIT IV VEGETABLE OILS **10 hrs.**

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS **10 hrs.**

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

TEXT BOOKS:

1. Richard L. Bechfold, Alternative Fuels Guide Book - SAE International Warren dale - 1997.
2. Maheswar Dayal, “Energy Today & Tomorrow”, I & B Horsier India - 1982.

REFERENCES

1. Nagpal, “Power Plant Engineering”, Khanna Publishers - 1991.
2. “Alcohols as motor fuels progress in technology”, Series No.19, SAE Publication USE - 1980.
3. SAE Paper Nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80. Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

Part B: **(100% Theory)**

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SAUX 1023	FUEL CELL AND APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO FUEL CELLS **10 hrs.**

Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

UNIT II FUEL CELLS FOR AUTOMOTIVEAPPLICATIONS **10 hrs.**

Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market.

UNIT III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE **10 hrs.**

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

UNIT IV FUELING **10 hrs.**

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

UNIT V FUEL CYCLE ANALYSIS **10 hrs.**

Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engine fueled by natural gas and hydrogen and hybrid electric vehicle.

TEXTBOOKS:

1. Fuel Cells for automotive applications, Professional Engineering Publishing UK. ISBN 1-86058-4233, 2004.
2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Mark: 80. Exam Duration: 3hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

Part B: **(100% Theory)** -

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks 60 ma

SMEX1028	COGENERATION AND WASTE HEAT RECOVERY SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I COGENERATION **10 hrs.**

Introduction – Principles of Thermodynamics – Combined Cycles-Topping -Bottoming – Organic Rankine Cycles – Advantages of Cogeneration Technology

UNIT II APPLICATION & TECHNO ECONOMICS OF COGENERATION **10 hrs.**

Cogeneration Application in various industries like Cement, Sugar Mill, Paper Mill etc. Sizing of waste heat boilers – Performance calculations, Part load characteristics selection of Cogeneration Technologies – Financial considerations – Operation and Investments – Costs of Cogeneration.

UNIT III WASTE HEAT RECOVERY **10 hrs.**

Introduction – Principles of Thermodynamics and Second Law – sources of Waste Heat recovery – Heat engines and other Power Plants –Heat pump for waste heat recovery.

UNIT IV WASTE HEAT RECOVERY SYSTEMS, APPLICATIONS & TECHNOECONOMICS **10 hrs.**

Design of waste heat recovery system – Heat exchanger – Theory and Design, organic fluid systems – analysis & Design

UNIT V ENVIRONMENTAL CONSIDERATIONS **10 hrs.**

Environmental considerations for cogeneration and waste heat recovery – Pollution.

REFERENCE BOOKS:

1. Charles H. Butler, Cogeneration, McGraw Hill Book Co., 1984.
2. JH Horlock, Cogeneration, Heat and Power, Thermodynamics and Economics,Oxford,1987.
3. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers, London, 1963.
4. Sengupta Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, Washington, 1983.
5. De Nevers, Noel., Air Polllution Control Engineering, McGrawHill, New York,1995.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1030	BIO-ENERGY CONVERSION TECHNOLOGIES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I BIOMASS CHARACTERISTICS & PREPARATION **10 hrs.**

Biomass sources and classification. Chemical composition and properties of biomass. Energy plantations . Preparation of biomass. Size reduction, Briquetting of loose biomass, Drying, Storage and handling of biomass.

UNIT II BIOGAS TECHNOLOGY **10 hrs.**

Feedstock for producing biogas, Aqueous wastes containing biodegradable organic matter, animal residues-sugar rich materials. Microbial and biochemical aspects and operating parameters for biogas production. Kinetics and mechanism. Dry and wet fermentation. Digesters for rural application-High rate digesters for industrial waste water treatment.

UNIT III PYROLYSIS AND THERMO CHEMICAL CONVERSION **10 hrs.**

Thermo chemical conversion of lignocelluloses biomass. Incineration for safe disposal of hazardous waste. Biomass processing for liquid fuel production. Pyrolysis of biomass-pyrolysis regime. Effect of particle size, temperature, and products obtained.

UNIT IV GASIFICATION OF BIOMASS **10 hrs.**

Thermo chemical Principles: Effect of pressure, temperature and introducing, steam and oxygen. Design and operation of fixed and fluidized bed Gasifiers,partial Gasification of Bio-mass By circulating fluidized bed, Safety aspects,Partial gasification of biomass by CFB.

UNIT V COMBUSTION OF BIOMASS AND COGENERATIONS SYSTEMS; **10 hrs.**

Combustion of woody biomass-theory calculations and design of equipment. Cogeneration in biomass processing industries. Case studies: Combustion of rice husk. Use of bagasse for cogeneration.

REFERENCE BOOKS:

1. Chakravarthy A., “Biotechnology and Alternative Technologies for Utilisation of Biomass or Agricultural Wastes”, Oxford & IBH publishing Co, 1989.
2. Mital K.M., “Biogas Systems: Principles and Applications”, ISBN –81-224-0947-4, New Age International publishers (P) Ltd., 1996.
3. Venkata Ramana P. and Srinivas S.N., “Biomass Energy Systems”,ISBN 81-85419-25-6, Tata Energy Research Institute, 1996.
4. Klass D.L., and Emert G.M., “Fuels from Biomass and Wastes”, Ann Arbor Since Publ. Inc. Michigan, 1985.
5. Khandelwal K.C. and Mahdi (SS), “Bio-Gas Tecnology”, Tata McGraw-Hill Pub. Co.Ltd , 1986.
6. Chawls O.P., “Advances in Bio-gas Technology” I.C.A.R., New Delhi, 1970.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks

SMEX1035	ENERGY ENGINEERING AND MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I ENERGY AND ENVIRONMENT **10 hrs.**

Energy Resources World energy consumption, green house effect, global warming, energy use patterns, scope for conservation, energy prices and policies.

UNIT II ENERGY CONSERVATION **10 hrs.**

Energy conservation scheme, energy surveying & auditing – energy cost – energy index cost – cost index, energy conservation in thermal systems, buildings, engineering & process industries, non conventional energy source schemes.

UNIT III ENERGY TECHNOLOGIES **10 hrs.**

Energy consumptions in boilers and furnaces – waste heat recovery systems – heat pumps and refrigerators, storage systems – heat exchangers

UNIT IV ENERGY MANAGEMENT **10 hrs.**

Principles of energy management – energy resource management – energy management information systems – Instrumentation and measurement – computerized energy management

UNIT V ECONOMICS AND FINANCE **10 hrs.**

Costing and cost optimization techniques – optimal target investment schedule – cost appraisal and profitability – needs and cost benefits of energy resources.

REFERENCE BOOKS:

1. Paul W.O., Callaghan, Energy Management, Mc Graw Hill Book Company, New Delhi,1993
2. Jose Goldemberry, Thomas B Johanson, Amulya K.N. Reddy & Robert H. Williams, Energy for a Sustainable World, Wiley Eastern Ltd., 1990
3. Raikhy P.S., and Paraminder Singh, Energy Consumption in India, Deep and Deep Publications, 1990
4. Murphy W.R., Energy Management, Butter Worths, London, 1982
5. Ray, D.A., Industrial Energy Conservation, Permagon Press, 1980

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks 20 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks 60 marks