UNIVERSITY OF MUMBAI
SCHEME OF INSTRU

CTION AND EVALUATION (R2007)
(with effect from the academic year 2010-2011)
COURSE: B.E. (MECHANICAL ENGINEERING)

SEMESTER: VII

Sr. No	Subjects	No. of periods of 1Hour			Duration of Theory Paper in Hours	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1	Machine Design– II	4	2	--	4	100	25	--	25	150
2	CAD/CAM/CIM*	4	2	--	4+2PE	100	25	25	--	150
3	Refrigeration and Air Conditioning	4	2	--	3	100	25	--	25	150
4	Manufacturing Planning and Control	4	--	2	3	100	25	--	25	150
5	Elective - I	4	2	--	3	100	25	--	25	150
6	Project	--	4	--	--	--	50	--	--	050
	TOTAL	**20**	**12**	**2**	**--**	**500**	**175**	**25**	**100**	**800**

*Common with Automobile engineering.
(PE) - Practical Examination

COURSE: B.E. (MECHANICAL ENGINEERING)

SEMESTER: VIII

Sr. No	Subjects	No. of periods of 1Hour			Duration of Theory Paper in Hours	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1	Automobile Engineering	4	2	--	3	100	25	--	--	125
2	Finite Element Analysis*	4	2	--	4	100	25	--	25	150
3	Industrial Engineering and Enterprise Resource Planning	4	--	2	3	100	25	--	--	125
4	Elective – II	4	2	--	3 #	100	25	--	25	150
5	Project	--	8	--	--	--	100	--	50	150
	TOTAL	**16**	**14**	**2**	**--**	**400**	**200**	**--**	**100**	**700**

*Common with Automobile engineering. # Theory paper duration for Elective Mechanical System Design consists of 4Hrs.

(PE) - Practical Examination

ELECTIVE SUBJECTS

Sr.No	Elective I (Semester VII)	Sr.No	Elective II (Semester VIII)
PAIRED ELECTIVES			
P1	Supply Chain Management*	**P1**	Business Process Re engineering*
P2	Cryogenic Engineering*	**P2**	Advanced Refrigeration and Air Conditioning*
P3	Nuclear Technology - I	**P3**	Nuclear Technology - II
OPEN ELECTIVES			
1	Micro Electro Mechanical Systems(MEMS) *	**1**	Introduction to Nanotechnology*
2	Power Plant Engineering	**2**	Non Conventional Energy Sources
3	Operations Research*	**3**	Project management*
4	Information Technology for Management of Enterprises*	**4**	Product Life Cycle Management*
5	Virtual Reality*	**5**	Artificial and Machine Intelligence *
6	Computational Fluid Dynamics*	**6**	Advanced Turbo machinery*
7	Industrial Robotics*	**7**	Mechanical System Design
8	Piping Engineering	**8**	Process Equipment Design
9	Dynamic System Modelling & Analysis		

***** Common with Automobile engineering.

Paired Electives :- If student selects sr. no.P1 as elective –I in semester VII then he/she has to choose sr. no.P1 as elective –II in semester VIII.

Open Electives :- Students can select any one subject as elective-I in semester-VII from sr. no. 1 to 6 and any one subject as elective-II in semester-VIII, from the list.

CLASS: B.E. (Mechanical)			Semester:- **VII**
SUBJECT: **MACHINE DESIGN - II**			
Periods per week. 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	04	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	Design of spur, helical, bevels and worm gears. Two stage Gear box consisting of spur and helical gear pair: design approach through system design, gear box housing layout and housing design	12
Module 02	Selection of rolling contact bearings based on constant /Variable Load & speed conditions (includes deep groove ball bearing, cylindrical roller, taper roller and self aligning bearing)	08
Module 03	Design of hydro dynamically lubricated bearings (Self contained) Introduction to hydro Static bearings Selection of Mechanical Seals	06
Module 04	Design of cam and follower mechanisms.	06
Module 05	Design of main components of centrifugal pump - Motor selection, Suction and delivery pipe, Impeller, Impeller shaft, Volute casing. (system design approach)	08
Module 06	Design of Snatch Block assembly including Rope selection, Sheave, Hook, Bearing for hook, cross piece, Axle for sheave and shackle plate	08

TERM WORK:

Term work shall comprise of

1) Exercises on the above topics in the form of design calculations with sketches and or drawings.
2) Design and detailed assembly drawing on **FULL** imperial drawing sheets of Min. **two** design problem, from the module 1, 4, 5 and 6
3) Course project*
4) Class Test based on above syllabus.

* **Course Projects-** There will be a course project where the students will be able to apply and integrate the knowledge gained during the course. The projects will be developed by teams of Two to Four students and will consist of design of any system having min. 5 to 6 components.

Class Assignments & Drawing Sheets : 10 Marks
Course Projects : 05 Marks

Class test	:	10Marks
Total	:	25 Marks

NOTE:
Use of standard design data books like PSG Data Book , Design Data by Mahadevan is permitted at the examination and shall be supplied by the institute.

Oral Examination:
Oral examination will be on maximum portion of the syllabus.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

TEXT BOOKS:

Machine Design Exercises	- S.N. Trikha, *Khanna Publications, Delhi*
Design of machine elements	- V. B. Bhandari *Tata McGraw Hill Pub.*
Machine Design - An Integrated Approach	- Robert L. Norton - *Pearson Education Asia.*
Mechanical Engineering Design	- J. E. Shigley - *McGraw Hill*
Machine Design Exercises	- S.N. Trikha, *Khanna Publications, Delhi*
Recommended Data Books	- PSG, K. Mahadevan

REFERENCES:

Gear Design Handbook	- Gitin Maitra
Material handling equipments	- N. Rudenko , *Peace Publication*
Material handling equipments	- Alexandrov, *MIR Publication*
Machine Design	- Reshetov - *Mir Publication*
Machine Design	- Patel, Pandya, Sikh Vol – I & II, *C. Jamnadas & Co. Educational & Law Publishers*
Design of Machine Elements	- V.M. Faires.
Design of Machine Elements	- Spotts.
Pumps	- Sahu

CLASS: BE(Mechanical)			Semester:-VII
SUBJECT: **CAD/CAM/CIM**			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical	2 (PE)	25
	Oral Examination		--
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**INTRODUCTION & ELEMENTS OF INTERACTIVE COMPUTER GRAPHICS** The design process, the role of modeling & communication, modeling using CAD, Product life cycle & CAD/ CAM, Concurrent engineering in Product design & development, Collaborative Engineering, computers for design Process, CAD System Architecture. The design workstation & its functions, Operator input devices (Mouse, keyboard, tracker ball & Joy Stick etc.), Output devices (Printers & Plotters), two dimensional computer graphics, vector generation, the windowing transformation, three dimensional Computer graphics, viewing transformation, Homogeneous coordinates, Perspective projection, Visual realism, Hidden line removal & hidden surface removal algorithm, light & shade ray tracing.	08
Module 02	**TECHNIQUES FOR GEOMETRIC MODELING** Graphic standards, The parametric representation of geometry, Bezier curves, Cubic Spline curve, B-Spline curve, parametric representation of line, circle, ellipse & parabola constructive solid geometry (CSG), Boundary Representation (B-Rep), Wire Frame Modeling, Solid Modeling, Surface Modeling, Parametric Modeling, feature based modeling, Feature recognition, Design by feature.	06
Module 03	**TRANSFORMATION, MAINPULATION & DATA STORAGE** 2D & 3D Transformations (Translation, Rotation, & Scaling & Magnification), Concatenations, Matrix representation, Problems & object oriented programming on Transformations. Object transformation, mirror transformation, Data Structures for interactive modeling, Bill of materials from attribute data, The use of Object Orientation & associatively, Engineering data management system, relational data base for design, object Oriental database, Structured Query language, Design information Systems. Artificial Intelligence in Design & Manufacturing, Representation of Knowledge, and Knowledge base Engineering.	08

Module 04	**NC & CNC TECHNOLOGY** Introduction, basic components of NC system, NC Procedure, NC Coordinate Systems, & NC motion control systems, Applications, Advantages & Disadvantages of NC machines. Punched tape in NC, Tape coding & format, Manual Part Programming, Computer Aided Part Programming, Problems with conventional NC, CNC functions & advantages, DNC, adaptive Control, CNC programming concepts, Trends & new developments in NC, Part programmers job, functions of a post processor, NC part programming languages, Elements of a APT language, The Macro Statement in APT, Subroutines, NC programming with interactive graphics. Constructional details of CNC machines, Feed back devices- Velocity & displacement, FMS, Machining Centers and its types, Automated Material Handling & storage Systems like Robots, AGVs and AS/RS etc.	12
Module 05	**Group Technology, CAPP, and CAQC** Introduction to GT, Part Families, parts Classification & Coding, GT Machine cells, Benefits of GT Introduction to Computer Aided Process Planning (CAPP), Retrieval type Process Planning Systems, Generative type Process Planning Systems, Benefits of CAPP, Artificial Intelligence in CAPP, PFA, Similarity coefficient matrix. Introduction to Computer Aided Quality Control (CAQC), Computers in QC, Contact Inspection methods, Non Contact Inspection methods, Computer Aided Testing, Integration of CAQC with CAD/CAM	08
Module 06	**COMPUTER INTEGRATED MANUFACTURING & TECHNOLOGY DRIVEN PRACTICES** Introduction, Evolution, Objectives, CIM Hardware and Software, CIM Benefits, Nature and role of the elements of CIM, Identifying CIM needs, Data base requirements of CIM, Role of CAD/CAM in CIM, Obstacles to Computer Integrated Manufacturing, Concept of the future CIM systems, Socio -techno- economic aspects of CIM. Rapid Prototyping, Virtual Prototyping, Design for Manufacturing, Design for Assembly and Dis- Assembly, Reverse Engineering and Data Capture techniques, Green Manufacturing.	07

TERM WORK:

Term work shall consist of class assignments, laboratory assignments, programming for transformations, part programming, part fabrication on CNC trainer, and written test. The distribution of marks for term work shall be as follows:

1. Assignments (at least one on each topic) - (05 Marks)
2. Assignments using 3D Modeling Software's like PRO-E, CATIA, UNIGRAPHICS, SOLID WORKS, IDEAS, HYPER MESH, Programming for Algorithms, transformations - (05 Marks)
3. Part Programming Exercises and machining/fabrication of components (at least two) on CNC machines (Turning and Milling each one) - (05 Marks)
4. Class test - (10 Marks)
5. **Total** **(25 Marks)**

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks

2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Practical Examination:

Practical examination of 2 hours duration based on any one of the followings

1) Programming for Algorithms, transformations
2) Part Programming and machining/fabrication of components (only simulation)
3) 3D Modeling of machine elements using Software's like PRO-E, CATIA, UNIGRAPHICS, SOLID WORKS, IDEAS, HYPER MESH, etc.

Text Books:

1. "CAD/CAM Computer Aided and Manufacturing" by Mikell P. Groover and Emory W. Zimmers, Jr., *Eastern Economy Edition,PHI*
2. "CAD/ CAM , Theory & Practice" by Ibrahim Zeid, R. Sivasubramanian, *Tata McGraw Hill Publications*
3. "Computer Graphics" by Donald Hearn and M. Pauline Baker, *Eastern Economy Edition*
4. "CAD/CAM Principles, Practice and Manufacturing Management" by Chris McMahon, Jimmie Browne, *Pearson Education*
5. "CAD/CAM/CIM" by P. Radhakrishan, S. Subramanyan, V. Raju, *New Age International Publishers*
6. "CAD/CAM Principles and Applications" by P.N. Rao, *Tata McGraw Hill Publications*
7. "Principle of Computer Graphics" by William .M. Neumann and Robert .F. Sproul, *McGraw Hill Book Co. Singapore.*
8. David L. Goetsch, Fundamental of CIM technology ,Delmar publication
9. David Bedworth, Computer Integrated Design and Manufacturing, *McGraw Hill.*
10. "CNC Machines" by B.S. Pabla and M. Adithan, *New Age International Publishers.*
11. "Numerical Control and Computer Aided Manufacturing" , T.K. Kundra, P.N. Rao, N.K. Tiwari, *Tata McGraw Hill*
12. "CNC Technology and Programming", Krar, S., and Gill, A., *McGraw Hill publishers*
13. "Computer Integrated Manufacturing- An Introduction with Case Studies" by Paul G. Ranky, *Prentice Hall International*
14. "Flexible Manufacturing Systems" by H.K. Shivanand, M.M. Benal, V.Koti, *New Age International Publishers*
15. "Automation, Production Systems and Computer Integrated Manufacturing ", Groover M.P., *Prentice-Hall of India Pvt. Ltd*
16. "Mathematical Elements for Computer Graphics", Rogers D F I and Adams J A, *McGraw-Hill.*

REFERENCE BOOKS

1. "Computer Integrated Manufacturing Hand Book" by Eric Teicholz, Joel N. Orr, *McGraw Hill International Editions*

CLASS:BE(Mechanical)			Semester:-VII
SUBJECT: **REFRIGERATION AND AIR CONDITIONING**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	---	---
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	1) Introduction to Refrigeration Carnot refrigerator, Carnot heat pump, Co-efficient of Performance, unit of refrigeration. 2) Aircraft Air refrigeration systems 2.1 Need for aircraft air-refrigeration 2.2 Simple air-cooling system 2.3 Bootstrap air cooling system 2.4 Reduced ambient air-cooling system 2.5 Regenerative air cooling system Comparison of above aircraft, air refrigeration systems	7
Module 02	3) Vapor Compression Refrigeration System 3.1 Simple vapor compression cycle. Effect of liquid sub cooling and suction vapor super heating. Liquid vapor heat exchanger (LVHE). Actual VCR cycle. 3.2Two stage VCR cycle. Water intercooler, Flash chamber, Multievaporators. 3.3 Refrigerants- Desirable properties of refrigerants. Designation system for refrigerants. Thermodynamic, Chemical and Physical properties. Secondary refrigerants. ODP and GWP. 3.4 Types of evaporators, condensers, expansion devices and Compressors. Defrosting.	9
Module 03	4 Vapor Absorption Refrigeration. 4.1 Importance of VAR system. 4.2 Amonia-water VAR system. Enthalpy-Concentration chart. Analysis of the system 4.3 Lithium Bromide – Water VAR system. Single and double effect. Electrolux refrigeration system	8

Module 04	5. Psychrometry 5.1 Psychrometric properties, chart and processes. Bypass factor, Apparatus dew point temperature. 5.2 Cooling tower- Types of cooling towers, tower approach, tower range, tower efficiency, tower losses, tower maintenance.	8
Module 05	6 Air-Conditioning 6.1 Adiabatic mixing of two air streams, RSHF, GSHF, ERSHF, Room apparatus dew point and coil apparatus dew point. Design of winter and summer air-conditioning systems. 6.2 Human Comfort- Effective temperature, Comfort chart, Comfort zone, air filters.	8
Module 06	7 Duct Design- Friction chart for circular ducts. Equivalent diameter of a circular duct for rectangular ducts. Static pressure regain and equal pressure drop methods of duct design. Fans and blowers. 8 Controls – Thermostat, LP/HP cutoff, Thermopiles, hygrometer, Interlocking control. 9 Applications- study of commercial ice making plant, house hold refrigerator, manufacturing of dry ice, window air conditioner, Liquefaction of gases (cryogenics), thermoelectric refrigeration. Deep sea water air-conditioning.	8

List of Experiments:

1) Assignments based on above syllabus (At least 10 numerical problems)
2) Experiments to find COP for equipments like water cooler, Window air conditioner, etc
3) Experiments involving the study of humidification dehumidification, heating and cooling. Mixing of two air streams.
4) Visit report- Cold storage plant / ice plant or air-conditioning plant.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of syllabus.

Term Work:

Term work shall consist of experiments, assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments/visit report): (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: …… (25) Marks.

Text Books:

1) Refrigeration and air-conditioning – C P Arora, *Tata McGraw Hill Publication*
2) Principles of refrigeration – R J Dossat, *Willey Eastern Publication*
3) Refrigeration and air-conditioning – W F Stoker and J W Jones, *Tata McGraw Hill Publication*
4) Modern Air-conditioning practice – C P Arora, *Tata McGraw Hill Publication*

References:

1) Refrigeration and air-conditioning- Manohar Prasad, *New Age Int (P) Ltd.*
2) Basic Refrigeration and air-conditioning- P.Ananthanarayana, Tata Mcgraw

CLASS: BE (Mechanical)			Semester:-VII
SUBJECT: **MANUFACTURING PLANNING AND CONTROL**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	--	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	---	---
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**Manufacturing Planning and control System:** Manufacturing – transformation process, Manufacturing as competitive advantage. Manufacturing system – components and types. Types of products. MPC system overview objectives and functions such as planning routing, scheduling, dispatching and follow up. **Forecasting:** Need for forecasting, Types of forecast. Extrapolative methods- Moving average method, Exponential smoothing method, Forecast errors, Linear trend model. Causal methods- Simple regression analysis.	8
Module 02	**Planning Function**: Capacity planning and aggregate planning. Master production schedule, Shop floor Control.	6
Module 03	**Planning for Material requirements:** MRP and MRP II, Concept of JIT. Inventory control systems, Economic Order Quantity. Buffer stocks. Purchase and Production type of inventory. Quantity discount.	9
Module 04	**Scheduling & Sequencing**: Scheduling concept, Scheduling of processes, Gantt chart, job shop scheduling, - Comparison of various methods, Sequencing of tasks using, Johnson's rule. **Project management**: Concepts of project planning, monitoring and control, Project management through network analysis, CPM & PERT, Cost analysis and crashing.	9
Module 05	**Advanced concepts in production planning I** : Mathematical programming approaches- Linear programming problem, Formulation, Simplex method for maximization and minimization, concept of duality.	8
Module 06	**Advanced concepts in production planning II** : Assignment model, Transportation model. **Simulation:** Need for simulation, Monte Carlo technique.	8

TERM WORK:

The Term work shall comprise of at least six assignments (Problems and Case Studies) covering different topics of the syllabus, One Seminar Presentation Report and One Test.
The distribution of marks for term work shall be as follows:

- Laboratory work (Assignments/Case studies/seminar): … (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Text Book:

1. Manufacturing Planning & Control Systems by Thomas E. Vollman. William L. Berry and others. Galgotia Publications
2. Production and Operations Mnagement by S. N. Chary - T. M. H. Publishing Company.
3. Modernization of Materials Management by L. C. Jhamb - Everest Publishing House.
4. Operation Research by Hamdy H. Taha, *Pearson/Prentice Hall*
5. Operation Research by Wayne Winston, *Cengage Learning*
6. Operation Research by Shah, Ravi, Hardik Soni, *PHI Learning*
7. Operation Research by Panneerselvam, *PHI Learning*
8. Production Operation Research by Adam Ebert, *PHI Learning*
9. Manufacturing Process Planning and System Engineering by Anand Bewoor, Dreamtech Press.

Reference Books:

1) Modern production / Operations management by Elwood S. Buffa & Rakesh K. Sarin, *Wiley*
2) Industrial and Production management by Martand Telsang, *S.Chand*
3) Manufacturing, planning and control Systems by Thomos Vollman , William Berry and others, *Tata Mc-Grow Hill.*
4) Operation Research by J K Sharma, *Macmillan*
5) Production Planning and Inventory Control by S.L.Narasimhan and other. *Prentice Hall*

CLASS: BE(Mechanical)			Semester:-VII
SUBJECT: **Supply Chain Management (Elective I)**			
Periods per week. 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
	Term Work	-	25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**1. INTRODUCTION TO SUPPLY CHAIN MANAGEMENT**: Current Business Scenario, Value Matrix Analysis, Evolution of SCM Function, Theme and Pillars of SCM System, How Supply chain works? Participants in the Supply Chain, Supply chain drivers, Supply chain structure	04
Module 02	**2. SUPPLY CHAIN OPERATIONS**: 2.1 Planning and Sourcing Demand forecasting ,Pricing and Promotional Impacts on demand, CPFR Concepts, CODP Concepts, Consensus Forecasting, Demand and Pricing Optimization 2.2 Making and Delivering Product Design, Production Scheduling, Facility Management, Order Management, Delivery Scheduling, Distribution network design, channels of Distribution, Plant and warehouse location.	12
Module 03	**3. MATERIALS MANAGEMENT IN SUPPLY CHAIN** Scope, importance, classification of materials, Procurement, Purchasing policies, vendor development and evaluation, Inventory control systems of stock replenishment, Cost elements New Supply Planning Paradigms, VMI, CMI,Green Channel supply, KM Model of Supplier Partnership, Multi-tier Supplier Partnerships Use of computers for materials function.	08
Module 04	**4. LOGISTICS** 4.1 Logistics Evolution, 8 wings of Logistics, Distribution Network Systems, Warehousing and Inventory Cross-Docs, Multi-Modal Optimization, Inbound and Outbound handling, Containerization, TPL, FPL, MPL Partnering, Reverse Logistics 4.2 Transportation: Individual Freight and passenger modes, intermodal transportation and third party transportation services, economic social, and political roles of transportation, demand, cost and service characteristics of different transport services, carrier selection and evaluation methods, contracting for transportation services, freight rate structure, Private fleet management, Claim management, International transportation, Ocean carrier management, port administration and	10

	regulation, costing and pricing issues of international transportation, logistics, cost transport mode choice, Dispatch decisions, routing decisions, routing Models, packaging to suit mode of Transport	
Module 05	**5. SUPPLY CHAIN COORDINATION AND USE OF TECHNOLOGY** The "Bullwhip" Effect, Supply Chain Coordination factors, Collaborative Planning, Forecasting, and Replenishment, supported information systems, E-Business and Supply Chain Integration, SCM systems Vendors, Types of Applications, Optimization Modeling, E-Business and Systems Integrations from ERP to SCM, KM, APS Systems, Further integration to CRM	06
Module 06	**6.1 MEASURING PERFORMANCE: SUPPLY CHAIN METRICS** Market Performance Categories, Framework for Performance Measurement,, Internal Efficiency Metrics, Demand Flexibility Metrics, Product Development Metrics, Benchmarking and SCM SCORE modeling **6.2 TOTAL DISTRIBUTION COST ANALYSIS**	06

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Case Study /Course Project: Report of 10 - 15 pages on any topic from syllabus

Term work shall consist of minimum 06 assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (course project / assignments): …… … (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: …… (25) Marks.

Text Books:

1. "Supply Chain Management: Concepts and Cases", Altekar Rahul V., *Prentice Hall of India, 2005*
2. Materials Management and purchasing, Ammer DS Taraporewala
3. "Modeling the Supply Chain", Jeremy F. Shapiro, *Thomson Learning Publication*

References:

1. Supply Chain Management Theories and Practices(Set) by R.P. Mohanty and S. G. Deshmukh , Biztantra Publication.
2. Logistics and Supply Chain Management, Martin Christopher, Richard Irwin
3. Supply Chain Management: Janat Shah, Pearson Education.

4. Principles of Supply Chain Management, Joel Wisner, G. Keong, Cengage Learning

CLASS: BE(Mechanical)			Semester:-VII
SUBJECT: **CRYOGENIC ENGINEERING (ELECTIVE I)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	1.1 Introduction to cryogenic systems - development and present state of affairs of cryogenic engineering. 1.2 Low temperature properties of engineering materials, thermal engineering and magnetic properties of cryogenic fluids.	06
Module 02	2. Gas liquefaction systems: system performance parameters, Thermodynamically ideal systems- Joule- Thomson-effect-adiabatic expansion- critical components of liquefaction systems.	08
Module 03	3. Gas separation and purification systems- cryogenic-refrigeration systems, expansion engines refrigeration systems.	10
Module 04	4. Phillips refrigerators, importance of refrigerator effectiveness, Vuilleumier refrigerator, Solvay refrigerator, Gifford-McMahon refrigerator, refrigerators using solids as working media.	08
Module 05	5.1 Measurements systems for low temperatures, temperature, pressure flow rate, and liquid level measurements. 5.2 Cryogenic fluid storage and transfer, system insulations. Importance of vacuum technology in cryogenics.	08
Module 06	Application of cryogenic systems, super conducting devices, space technology, cryogenic in biology and medicine.	08

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments at least one on each module, seminar report and written test. The distribution of marks for term work shall be as follows:

- Assignments and seminar report: …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Cryogenics Systems - R. Barron *Oxford University Press*
2. Cryo-Cooler, Fundamentals Part-I- G.Walker *Plenum Press New York*
3. Cryo-Cooler, Fundamentals Part-II - G.Walker *Plenum Press New York*

References:

1. Sterling cycle design manual - Martini W. *NASA Report, 1978*

CLASS: BE (Mechanical)			Semester:-VII
SUBJECT: **Nuclear Technology – I (Elective –I)**			
Periods per week. 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination	--	25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 1	**1. Introduction :-** Atomic Structure, Isotopes, Binding Energy, Nuclear energy from fission and fusion reactions, Application areas of nuclear energy- Power plant, Research, Agriculture, medicine and Industry, world scenario on peaceful use of nuclear energy, Share of nuclear energy to overall power production in India, India's relation with world bodies with regard to nuclear material import and technological co-operation, India's program on nuclear energy.	6
Module 02	**2. Radioactivity**:- Radioactive particles, Interaction with matters, radioactive units, measurements.	4

Module 03	**3. Reactor Physics**:- 3.1 Neutron Reactions:- Interaction of neutron with matters, Cross Sections, Fertile, Fissile and Fissionable materials, Fission process, fission process, Chain reactions, Energy releases from fission and fusion processes 3.2 Diffusion and Slowing down of neutron:- Diffusion theories and equations, Elastic and Inelastic scattering, Moderating ratio, Lethargy, Spatial distribution of slowed down neutrons, Age, Migration length, neutron flux – thermal and fast neutrons. 3.3 Reactor Theory:- Criticality condition, Multiplication factors, Four factor formula, Critical size, Non leakage probability, Reflectors, Heterogamous and homogenous reactor systems, Modified four factor formula, Buckling, Thermal Reactor, Fast Reactor, experimental Determination of critical size, Neutron life time, Period, Delayed Neutrons, Reactivity, Temperature coefficient of reactivity, Fission product poison, Burn up power coefficient of reactivity , Void coefficient of reactivity, Effect of isotopic purity of moderator, coolant on reactivity, reactivity units, control of reactivity for reactor operations – Start up from various conditions, power variations, shutdown.	14
Module 4	**4.0 Nuclear Power plant (NPP):** - 4.1 Inland and off land reactors; 4.2 Thermal reactors: Types: BWR, PWR, PHWR, GCR, Advance thermal reactors' Fast Reactors- Concept of breeding, coolant, core composition; Fusion power reactor. 4.3 Off land reactor: space power unit, submarines. 4.4 Conventional System in NPP: Secondary Steam and feed water system, Power generation and Distribution.	8
Module 05	**5.0 Radiation Protection and Radioactive Waste Management:** 5.1 Radiation Protection: Radiation exposure hazard, Dose units, Radiation instrument / equipment, Personal radiation protection 5.2 Radioactive Waste Management: Segregation, Handling, Storage / disposal.	8
Module 06	**6.0 Safety Aspects and Regulation on use of nuclear energy:-** 6.1 Safety Aspects: Instrumentations for reactor control Control of reactivi**t**y, Core Cooling, Containment of reactivity. Emergency power supply, dedicated powers supply and Evacuation scheme, Innovative and revolutionary features of power reactors. 6.2 Regulations on the use of Nuclear energy**:** Functions of National regulatory body, Safety requirement, Safety review, Regulatory consents, Inspection and Enforcement.	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be based on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (Assignments): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. NPP of Power Plant Engg- A.K. Raja, A.P. Srivastava & M. Dwivedi
2. An Introduction on Nuclear Engineering, A course in Power Plant Engg- Arora & Domkundwar
3. Nuclear Power Plant, Power Plant Engg. (Steam & Nuclear)- P.K. Nag.

Reference Book:

Nuclear Engineering- Glasstone & Sesonske.

CLASS: BE (Mechanical)			Semester:-VII
SUBJECT: **MICRO ELECTRO MECHANICAL SYSTEMS (MEMS) ELECTIVE-I**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical		---
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	Historical Background: Silicon Pressure sensors, Micromachining, Micro Electro Mechanical Systems. Microfabrication and Micromachining: Integrated Circuit Processes. Potential of MEMS in industry.	6
Module 02	Bulk Micromachining : Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA)	7
Module 03	Physical Microsensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors. Microactuators: Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors Microactuator systems: Success Stories, Ink-Jet printer heads, Micro-mirror TV Projector.	8
Module 04	Microstereolithography (MSL) for 3D fabrication, Two photon MSL, Dynamic mask MSL, scanning systems, Optomechatronics system for MSL. Ceramic and Metal Microstereolithography.	9
Module 05	Ceramic and Metal Microstereolithography. Scattering of light by small particles. Effect of particle properties on accuracy and resolution of component in Ceramic and Metal MSL. Monte carlo ray tracing method. Nanolithography.	8
Module 06	Surface Micromaching: One or two sacrificial layer processes, Surface micromachining requirements, Polysilicon surface micromachining, Other compatible materials, Silicon Dioxide, Silicon, Micromotors, Gear trains, Mechanisms. Characterisation of MEMS devices.	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall comprise of

1) Exercises on the above topics in the form of design and manufacturing strategies for MEMS components.
2) Assignments (at least one on each module)
3) Educational visit to any one MEMS industry. Student shall submit the brief report of visit.
4) Seminar on topic related to MEMS
5) Class Test based on above syllabus.

The distribution of marks for term work shall be as follows:

- Laboratory work (Exercise/assignments/visit report/seminar) : (15)Marks.
- Test (at least one): …… (10)Marks.

TOTAL: ……. (25)Marks.

Text Books: .

1. MEMS, Vijay Vardan, *Wiley Publication*
2. MEMS and Microsytems Design and Manufacture, Tai- Ran Hsu, *Tata McGraw Hill*
3. MEMS, Nitaigour Mahalik, *Tata McGraw Hill*
4. MEMS and MOEMS Technology and Applications, Rai Chaoudhary, PHI Learning

References:

1. Stephen D. Senturia, Microsystem Design, *Kluwer Academic Publishers,*
2. Marc Madou, Fundamentals of Microfabrication, *CRC Press*
3. Kovacs, Micromachined Transducers Sourcebook, WCB *McGraw-Hill, Boston*
4.M-H. Bao, Elsevier, Micromechanical Transducers: Pressure sensors, accelerometers, and gyroscopes, New York, 2000.

CLASS: BE (Mechanical)			Semester:-VII
SUBJECT: **POWER PLANT ENGINERING (ELECTIVE-I)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	1 Economics of the power plant: Load curve, load duration curve, various factors, effect of fluctuating load on operation and design of the plant, methods of meeting fluctuating load. Selection of the generating equipments, load sharing, cost of electrical energy. Tariff methods. Performance and operating characteristics of Power Plants.	
Module 02	2.1 Hydro power plant: Rainfall, runoff and its measurement, hydrograph, flow duration curve, mass curve, and reservoir storage capacity. Classification of the plants- Run-off river plant, storage river plant, pumped storage plant. 2.2 Fluidized bed combustion- regimes of combustion, circulating and pressurized fluidized bed combustion system, Fluidized bed boilers, its important features, classification. Control of Nitrogen oxides.	
Module 03	3.1 Nuclear power plant: Introduction of nuclear engineering- radioactive decay, half life, fission, fusion, nuclear materials. Thermal fission reactors and power plant - PWR, BWR, Liquid metal fast breeder reactors. Reactor control.	
Module 04	4.2 Diesel and Gas turbine power plant: General layout, application of diesel power plant, advantages and disadvantages, component, performance of gas turbine power plant, gas turbine material.	
Module 05	5.1 Combined cycle power generation: Coupled cycle- thermodynamics, combined cycle plant-thermodynamics of GT-ST plant operation; Advantages. Base Load plants. Peak load plants. Co-ordination of different types of power plants.	
Module 06	Environmental impact of power plant: Social and economical issues of the power plants, Greenhouse effect, Acid precipitation- acid rain and acid snow, dry deposition and acid fog, Thermal pollution, air pollution, Radiation from nuclear power plant effluents. Coal storage, Inplant handling of coal, Ash handling systems. Dust collectors. Flue gas, desulfarization methods.	

Educational Visit:
Organize at least one visit to power station. Student shall submit a brief technical report of the visit as a part of term work.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:
Oral examination will be on maximum portion of the syllabus.

Term Work:
Term work shall consist of minimum **06** assignments at least one on each module, and written test. The distribution of marks for term work shall be as follows:

- Assignments and visit report: …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: …… (25) Marks.

Text Books:

1. Power Plant Engineering - P. K. Nag - *Tata McGraw Hill*
2. Power Plant Technology - M. M. EL - Wakil - *McGraw Hill*
3. Power Plant Engineering - Morse
4. Power Plant Engineering - Domkundwar
5. Power Plant Engineering - P. C. Sharma
6. Power Plant Engineering - Rajput

References:

1. Power Plant Engineering - Gaffert
2. Power Plant Theory & Design - P.J. Potter - Ronald Press
3. Modern Power Plant Engineering - J. Weisman, R. Eekart
4. Power Station Engineering & Economy'- Skrotzki
5. The Elements of Nuclear Power - Bennet, Thomson
6. Standard handbook of Power Plant Engineering - Elliott
7. Modern Power Station Practice: Vol. 1 to 8 - *British Electricity Intl., London - Paragamon Press*

CLASS: BE (Mechanical)			Semester:-VII
SUBJECT **OPERATION RESEARCH (ELECTIVE-I)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**Linear Programming**: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques - Two–phase method, Big-M method – Duality Principle	12
Module 02	**Transportation problem**: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem. **Sequencing** – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines	7
Module 03	**Replacement**: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement. **Queuing Models**: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals	7
Module 04	**Game Theory**: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle – m X 2 & 2 X n games –graphical method.	6
Module 05	**Inventory Models**: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.	8
Module 06	**Dynamic programming**: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem **Simulation**: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages – Simulation Languages	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments at least one on each module, and written test. The distribution of marks for term work shall be as follows:

- Assignments and visit report: …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. A.Ravindran , D Phillips, Operations Research :Principal and Practices, Wiley India.

2. Operations Research / S.D.Sharma-Kedarnath.

References:

1. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi /Pearson Education
2. Operations Research: Methods and Problems / Maurice Saseini, Arhur Yaspan and Lawrence Friedman
3. Operations Research / R.Pannerselvam,PHI Publications.
4. Introduction to O.R/Hiller & Libermann (TMH) O.R/Wayne L.Winston/Thomson Brooks/cole
5. Introduction to O.R /Taha//Pearson Education

CLASS: BE(Mechanical)			Semester:-VII
SUBJECT: **Information Technology for Management of Enterprises (ELECTIVE I)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**IT in the Organization** **1.1 Organizational Performance: IT support and Applications.** Doing Business In the Digital Economy, Business pressures, organizational performance and responses and IT support, Information Systems and Information Technology, the adaptive , Agile, Real time Enterprise, Information Technology Development and Trends. **1.2 IT Support Systems: Concepts and Management** Information Systems Concepts and Definitions, Classifications and Types of Information Systems, How IT supports People and Organizational Activities, How It supports Supply Chains and Enterprise Systems, Information Systems Infrastructure and Architecture, Emerging Computing Enviornments:SaaS, SOA and more, Managerial issues.	05
Module 02	**IT Infrastructure:** **2.1 Managing Data: Databases and warehousing.** Data Management A Critical success Factor,, File management, Databases and Data Base Management Systems, Creating Databases, Data warehousing, Marketing databases in action, Web Based Data Management Systems, Managerial issues. **2.2 Networks Computing for Collaboration** Discovery Search and Customized Delivery, Communication, Messaging and Collaboration, Social and Ethical issues, Managerial Issues.	07

Module 03	**<u>The Web revolution</u>** **3.1 E Commerce and E Business:** Overview of E Business and E commerce, Major EC Mechanisms, Business to Consumer applications, B2B Applications,Major models of E Business : From E-Government to C2C, e Commerce Support Services : Advertising Payments and order Fulfillment, Ethical and legal issues in E Business, Managerial Issues. **3.2 Wireless Devices and their applications:** Mobile Computing and Commerce: Overview Benefits and Drivers, Mobile applications in Financial Services, Mobile Shopping Advertising and Content providing, Mobile enterprise and Interbusiness Applications, Mobile consumer Services and Entertainment, Location Based Services and Commerce, Pervasive Computing, Managerial Issues.	08
Module 04	**<u>Organizational Applications</u>** **4.1 IT Compliance: Functional Applications and Transaction Processing** Functional informational Systems, transaction processing Information systems, Managing Production / Operations and Logistics, Managing Marketing and Sales Systems, Managing the accounting and Finance Systems, Managing human Resource Systems, Integrating Functional Information Systems, How IT supports compliance, Managerial Issues. **Understanding Enterprise Systems: Supply Chain** Essentials of Enterprise systems and supply chains, supply chain challenges, supply chain opportunities, Business value of Enterprise systems, Enterprise resource planning systems, Business Process Management, Product life cycle Management, Customer Relationship Management, Managerial Issues **4.2 Global and Interorganizational Information Systems:** Interorganizational Activities and order fulfillment, Interorganizational information Systems and Virtual Corporations, Global Information Systems, Facilitating IOS and Global Systems from Demand driven Networks to RFID, Interorganizational Information Integration, Partner relationship Management and collaborative commerce, Managerial issues.	10

Module 05	**Managerial and Decision Support Systems** **5.1 Managing Knowledge** Introduction to Knowledge Management, Organizational Learning and Memory, knowledge management activities, Approaches to Knowledge management, Information Technology in Knowledge Management, knowledge Management Systems implementation, Roles of people in knowledge management, Ensuring Success of KM Efforts, Managerial Issues. **5.2 Corporate Performance Management and Business Intelligence**: A framework of Business Intelligence: concepts and Benefits, Business Analytics: Online analytical processing reporting and querying, Data Text Web mining and Predictive Analytics, Data Visualization, Geographical Information Systems and virtual reality, real time business intelligence, and competitive Intelligence, Business Performance Management Scorecards and Dashboards, Managerial Issues. **5.3 Managerial Decision making and IT support systems** Managers and Decision making, Decision support systems,: for Individuals groups and Enterprise, Intelligent Support Systems : The basics, Expert Systems, Other intelligent systems, Automated Decision Support (ADS), Managerial Issues.	10
Module 06	**Implementing and Managing IT** **6.1 IT: Strategic objectives and Planning** IT Strategic Alignment, Competitive Forces Model, Value Chain Model, Strategic Resources and Capabilities, IT Planning, Interorganizational and international IT planning, Managing the IS department, Managerial issues. **6.2 Economics of IT:** Financial and Economic Trends and the productivity paradox, Evaluating IT investment: Benefits Costs and Issues, Methods for evaluating and justifying IT Investment, IT Economics strategies: Chargeback and Outsourcing, Economic aspects of IT and Web Based Systems, Managerial Issues. **6.3 IT Application Acquisitions and Options** The landscape and framework of IT Application Acquisition, Identifying Justifying and planning IT systems applications, Acquiring IT applications: available options, Outsourcing, application service providers and utility computing, selecting an acquisition approach and other implementation issues, Connecting to Databases, Enterprise systems and Business Partners, Business Process Redesign, Managerial Issues.	08

Theory Examination:

1. 1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:
Oral examination will be on maximum portion of the syllabus.

Term Work:
Term work shall consist of minimum **06** assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:
1. Efrain Turban, Dorothy Leidner, Ephrain McLean, James Wetherbe "Information Technology for Management: Transforming Organizations in the Digital Economy", 6th edition. ISBN: 978-8126-51441
2. Management of Information Technology, Carroll Frenzel, Cengage Learning
3. Information Technology for Management- Henry Lucas, Tata McGraw Hill

Reference
1. IT systems Management , Rich Schiesser, Eastern Economy Edition
2. IT Strategy and Management, Sanjiva Shankar Dubey, Prentice Hall

CLASS: BE (Mechanical)			Semester:-VII
SUBJECT: **VIRTUAL REALITY (ELECTIVE I)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**1.1 Introduction**: A short history of early virtual reality, early commercial VR Technology, VR becomes an Industry, The five classical components of VR Systems. **1.2 Input Devices: Trackers, Navigations and Gesture Interfaces**. Three Dimensional Position Trackers: Tracker performance parameters, Mechanical trackers, Magnetic trackers, Ultrasonic trackers, Optical Trackers and Hybrid Inertial Trackers Navigation and Manipulation Interfaces: Tracker based Navigation/Manipulation Interfaces, Trackballs, and three Dimensional	06

	Probes Gesture Interfaces: The Pinch Glove, the 5DT Data Glove, the Didjiglove, the Cyberglove	
Module 02	**2. Output Devices: Graphical, Three Dimensional Sound and Haptic Displays.** Graphical Display: The human visual system, personal graphics displays, large volume displays. Sound displays: the human auditory system, the convolvotron, Speaker based three dimentional sound. Haptic Feedback: The human haptic system, Tactile Feedback Interfaces, Force Feedback Interfaces.	08
Module 03	**3. Computing Architectures for Virtual Reality:** The Rendering Pipeline: The graphical rendering pipeline, The haptics rendering pipeline. PC Graphics Architectures: Pc Graphics Accelerators, Graphics Benchmarks. Work Station Based Architectures: the Sun Blade 1000 Architecture, The SGI Infinite Reality Architecture. Distributed VR Architectures: Multipipeline Synchronization, Colocated rendering Pipelines, Distributed Virtual Environments.	08
Module 04	**4. Modeling:** Geometric Modeling: Virtual Object Shape, Object Visual Appearance. Kinematics Modeling: Homogeneous Transformation Matrices, Object Position, Transformation Invariants, Object Hierarchies, viewing the three dimensional words. Physical Modeling: Collision Detection, Surface Deformation, Force Computation, Force Smoothing and Mapping, Haptic Texturing. Behavior Modeling and Model Management: Level of Detail Management, Cell Segmentation.	08
Module 05	**5.1 Virtual Reality Programming:** Toolkits and Scene Graphs. World Toolkit: Model Geometry and Appearance, The WTK Scene Graph, Sensors and Action Functions, WTK Networking, JAVA 3D: Model Geometry and Appearance, Java 3D Scene graph, Sensors and Behaviors, Java 3D Networking, WTK and Java 3D Performance Comparison. General Haptics Open Software Toolkit: GHOST Integration with the Graphics Pipeline, The GHOST Haptic Scene Graph, Collision Detection and response, Graphics and PHANToM Calibration. **5.2 Human Factors in Virtual Reality:** Methodology and Terminology: Data Collection and Analysis, Usability Engineering Methodology. User Performance Studies: Test bed Evaluation of universal VR Tasks, Influence of System Responsiveness on User Performance, Influence of Feedback Multimodality.	10

Module 06	**6.1 Traditional Virtual Reality Applications:** Medical Application of VR: Virtual Anatomy, Triage and Diagnostic, Surgery and Rehabilitation. Education, Arts and Entertainment: VR in Education, VR and the Arts, Entertainment Application of VR. Military VR Application: Army use of VR, VR Application in Navy, Air Force use of VR. **6.2 Emerging Application of VR:** VR Application and Manufacturing: Virtual Prototyping, other VR Application in Manufacturing, Application of VR in Robotics: Robot Programming, Robot Tele operation. Information Visualization: Oil Exploration and Well Management, Volumetric Data Visualization.	08

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (assignments): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

References:

1. Grigore Burdea, Philippe Coiffet, " Virtual Reality Technology" 2nd edition. Wiley India
2. John vince, "Virtual Reality Systems" Pearson Education Asia
3. Understanding Virtual Reality , Sherman,Elsever.

CLASS: BE (Mechanical)			Semester:- VII
SUBJECT: **COMPUTATIONAL FLUID DYNAMICS**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical		--
	Oral Examination		25
	Term Work		25

	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**1. Introduction** 1.1 What is CFD 1.2 Scope and Application of CFD 1.3 Methods of Predictions like Experimental, Theoretical 1.4 Working of Commercial CFD Softwares 1.5 Solution methodology-Preprocessing, Solver, Post processing	6
Module 02	**2. Mathematical description of Physical Phenomenon** 2.1 Governing Differential Equations 2.1.1 Meaning of Differential equation 2.1.2 The Continuity Equation 2.1.3 A Momentum equation 2.1.4 The Energy Equation 2.1.5 The General Differential Equation 2.2 Boundary Conditions 2.2.1 Initial and Boundary Conditions 2.2.2 Initial and Boundary Value problems	10
Module 03	**3. Grid Generation and Discretization Methods** 3.1 Structured and unstructured Grids 3.1.1 O-type, H-type, C-type of Structured Grid Generation 3.1.2 Mesh Adaptation 3.2 The Nature of Numerical Methods 3.2.1 The Discritization Concept 3.2.2 The Structure of the Discritization Equation 3.3 Methods of Deriving the Discretization Equations 3.3.1 Taylor-Series Formulation 3.3.2 Variational Formulation 3.3.3 Method of Weighted Residuals 3.3.4 Control Volume Formulation 3.4 Methods for finding the Solution of Discretized Equations	12
Module 04	**4 Heat Conduction** 4.1 Steady One-dimensional Conduction 4.2 Unsteady One-dimensional Conduction 4.3 Two and Three-dimensional Situations 4.4 Over relaxation and Under relaxation	6
Module 05	**5. Convection and Diffusion** 5.1 Steady One-dimensional and Two Dimensional Convection-Diffusion 5.2 Unsteady One-dimensional Convection-Diffusion 5.3 Unsteady Two-dimensional Convection-Diffusion 5.4 Solution of Steady heat Conduction by FEM	6

Module 06	**6. Incompressible Fluid Flow** 6.1 Governing Equations, 6.2 Stream Function-Vorticity Method 6.3 Determination of Pressure for Viscous Flow 6.4 The SIMPLE, SIMPLER Algorithm 6.5 Introduction to Turbulence Modeling 6.5.1 Basic Theories of Turbulence 6.5.2 The Time-Averaged Equations for Turbulent Flow	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments/tutorials and written test. The distribution of marks for term work shall be as follows:

- Tutorials/assignments: ……. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Versteeg.H.K. , Malalasekera.W. : " An introduction to computational fluid dynamics- The finite volume method", Prentice Hall

2. Anderson, D.A.,Tannehill, I.I., and Pletcher, R.H., Computational Fluid Mechanics and Heat Transfer,Hemishphere Publishing Corporation, New York, USA, 1984.

3. Niyogi.P.,Laha M.K., Chakrabarty S.K.: " Introduction to Computational Fluid Dynamics". Pearson Education, India.

References:

1. Muralidhar, K.,and Sundararajan,T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House ,New Delhi1995.
2. Ghoshdasdidar, P.S.,"Computer Simulation of flow and heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.

3. Subas, V.Patankar "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation
4. Taylor, C and Hughes J.B.,Finite Element Programming of the Navier Stock Equation, Pineridge Press Ltd.,U.K.1981.
5. Fletcher, C.A.J.,"Computational Techniques for Fluid Dynamics 1" Fundamental and General Techniques, Springer-Verlag,1987.
6. Flectcher, C.A.J., "Computational Techniques for Different Flow Categories, Springer-Verlage
7. Bose,T.K.,"Numerical Fluid Dynamics" Narosa Publishing House, 1997..
Schlichting, H.: " Boundary layer theory, McGraw-Hill, New York
8. Pope Stephen: " Turbulence"
9. Computational Fluid Dynamics, A practical approach tu et al ,ELSEVER.

CLASS: BE (Mechanical)			Semester:-VII
SUBJECT: **INDUSTRIAL ROBOTICS (ELECTIVE I)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**1.1 INTRODUCTION:** Automation & robotics, Robotic System & Anatomy Classification, Future Prospects **1.2 DRIVES:** Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators , Power Transmission Systems. **1.3 ROBOT & ITS PERIPHERALS:** End Effecters - types, Mechanical & other grippers, Tool as end effecter **1.4 SENSORS:** Sensors in Robotics, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Uses Vision Systems - Equipment	8
Module 02	**2 MACHINE VISION:** Introduction, Low level & High level vision, Sensing & Digitising, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Applications	8
Module 03	**3 PROGRAMMING FOR ROBOTS:** Methods, Robot programme as a path in space, Motion interpolation, level & task level languages, Robot languages; Programming in suitable languages Characteristics of robot.	8
Module 04	**4 ROBOT KINEMATICS:** Forward, Reverse - & Homogeneous Transformations, Manipulator Path Control, Robot Dynamics.	7
Module 05	**5 ROOT INTELLGENCE & TASK PLANNING:** Introduction, State space search, Problem reduction, Use of predictive logic, Means -Ends Analysis, Problem solving, Robot learning,- Robot task planning.	9
Module 06	**6.1 ROBOTIC APPLICATION IN MANUFACTURING:** Material transfer, Machine loading & unloading, Processing operations, Assembly & Inspectors, Robotic Cell Design & Control. **6.2 SOCIAL ISSUES & ECONOMICS OF ROBOTICS**	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments at least one on each module, programming of robots and written test.

- Laboratory work (assignments, programming of robots): (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

References:

1. Robotics for Engineers - Yorem Koren
2. Robotics in Practice - J. F. Engelberger
3. Computer Integrated Manufacturing Technology and Systems - Ulrich rembolds, Christial Blume .
4. Computer Aided Design in Mechanical Engineering - Ramamurthy
5. Robot Dynamics and Control by Mark Spong, Wiley India
6. Robotics - John Craig
7. Robot manipulators: mathematics, Programming and Control - Paul r p
8. Industrial Robotics - Groover and Simmers
9. Measurement systems - Ernest deoblin
10. Mechanical Measurements - Beckwith and Lewisbuck
11. Modern control Engineering - K. Ogata ,PHI
12. Automatic -Control- Systems - Benjamin Kuo, Wiley India
13. Robotic Engineering An Integrated approach - Richard D. KIafter and et. al. PHI
14. Intelligent Robotic Systems - Spyros G. Tzafestas

CLASS: BE (Mechanical)			Semester:-VII
SUBJECT : **PIPING ENGINEERING (ELECTIVE-I)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**Introduction to Piping** Introduction to phases of plant design**,** Role of Piping within project plan. Design Philosophy, Process data sheets, Process flow diagram, Piping & Instrumentation diagrams, and Equipment layout. Interdisciplinary inputs/coordination.	8
Module 02	**Piping fundamentals** Piping elements (pipes, fittings, flanges , gasket ,bolting ,Valves) ,,Pipe schedule, Pipe thickness calculations, pipe fittings (bends, elbow ,Tees , Reducers, Stub ends, cross), Special pipe fittings, expansion joints, types of flanges, pressure temperature rating for flanges, Pipe hydraulics & Sizing.	10
Module 03	**Piping Codes & Standards** American Standards, Indian standards, British Standards for Piping Engineering. Selection of Design code. Unified numbering system (UNS). **Piping materials** : ASME ,ASTM , IS , DIN materials for piping components such as pipe , fittings , flanges ,bolting , supports ,expansion joints, valves etc. Selection of materials.	8
Module 04	**Piping Drawing** Piping symbols, orthographic (Plan & Elevation) drawings, Isometric Drawings. **Plot Plan**, **Equipment Layout, & Piping GA Drawings**. Plot Plan Development & Requirements(General guidelines) Equipment Layout Terminology, Control Point & Battery Limits. Preparation of Equipment Layout. Piping GA Drawing Requirements and Layout Procedure. Pump GA Drawing and Layout Consideration. Tank & Vessel Layout Consideration. GA - Print Reading Exercise	10
Module 05	**Piping supports** Fixed supports like Rest , Line guide, Line stop ,Hold down, Rigid strut etc., Flexible supports like variable spring support, constant spring support, Snubber etc.	4
Module 06	**Piping Stress Analysis :** Need of Stress Analysis, Procedure to carry out stress analysis,Loads on the piping system(such as sustained , thermal, occassional, hydro-test loads, water hammer, relief valve outlet)**,** Allowable stress**,** Flexibility analysis, thermal load calculations, critical line list preparation , Steps involve in stress analysis of piping system, Pipe support	8

	span calculations, expansion loop & expansion joints ,software's used for stress analysis of piping system .	

Theory Examination:

5. Question paper will comprise of total seven question, each of 20 Marks
6. Question one will be compulsory and based on maximum part of syllabus.
7. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

ASSIGNMENTS

1 Introduction to Piping .
2 Piping fundamentals .
3 Piping Codes & Standards.
4 Piping materials.
5 Piping supports
6 Piping Stress Analysis.
7 Introduction to Modeling software's (PDMS, PDS etc.) & Stress analysis (CAESAR II) software's.

PRACTICALS

1 Draw Piping Symbols.
2 Draw General Arrangement for Plant Layout.
3. Pipe rack width calculation.
4. Draw Isometric drawing of any 5 piping systems

- Laboratory work (assignments, programming of robots): (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

References:

1. Mohinder L. Nayyar , Piping Handbook , McGraw-Hill Publication
2. Macetta , John. "Piping Design Handbook", M. Dekker , 1992
3. ASME code for Process Piping ,ASME B31.1
4. ASME code for Process Piping , ASME B31.3
5. ASME B16.5 , Pipe ,Flanges & Flange Fittings
6. An International Code 2007 ASME Boiler & Pressure Vessel Code, Rules For Construction of Pressure Vessels , Section II A,B,C&D.

CLASS: BE. (Mechanical)			Semester:- **VII**
SUBJECT: DYNAMIC SYSTEM MODELLING & ANALYSIS (ELECTIVE I)			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	--	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**Introduction to dynamic systems.** **Mathematical Modeling of Dynamic Systems:--Using Newton's law of cooling, Torricelli's law, Radiocarbon dating, Radioactive Decay, Skydiver, Mixing problem, Kirchhoff's law, Terminal velocity, Motion of chain on pulley etc.** **Analysis and Design of Dynamic Systems.**	**08**
Module 02	**Complex Analysis: Complex numbers in Rectangular &Polar forms.** **Complex variables and Complex function.** **Differential Equations: Linear Differential Equations with constant Coefficients.** **Laplace Transform: Laplace transformation of Derivatives & Integrals.** **Inverse Laplace Transformation, Shift on t-axis & S-axis** **Applications of Laplace Transform: System Response- First order system / Second order systems. Initial Value Theorems, Final Value Theorems.**	**08**
Module 03	**Matrix Analysis: Vectors& Matrices. Determinants, Inverse & Rank of matrix, Eigen values & Eigen vectors, Partitioning of Matrices, Matrix Transformation & Diagonalization.**	**04**

Module 04	**. System Model Representation** **Configuration Form** **State Space Representation** **Input- Output Equation.** **State Space Representation From I / O Equation & from Transfer function & Transfer Function from State Space.**	**08**
Module 05	**Mechanical System: Translation system, Rotational system ,Geared system.** **Electromechanical system: Elemental Relations of Electromechanical systems. Armature-Controlled DC Motors. Field-Controlled DC Motors.** **Electric Network** **Fluid & Thermal Systems**	**12**
Module 06	**MATLAB Basics: Introduction, Statements of variables, Vectors, MATLAB Functions, Printing and Graphics, Linear Algebra, Matrix Operations, Laplace Transforms.** **MATLAB Tutorial: Single Degree of Freedom Systems, Tow Degree of Freedom Systems, Transient Response Analysis, Response to Initial Condition**	**08**

TERM WORK:
Term work shall comprise of the class assignments and a class test based on above syllabus.

Class Assignments : 15 Marks
Class test : 10 Marks
Total : 25 Marks

TEXT BOOKS:
- DYNAMIC SYSTEMS Modeling and Analysis – Hung V. Vu & Ramin S. Esfandiari. McGRAW-HILL INTERNATIONAL EDITIONS
- System Dynamics – Katsuhiko Ogata PEARSON Education
- Engineering System Dynamics—Rao V. Dukkipati. Narosa Publication
- Control Systems Engineering – Norman S. Nise. WILEY STUDENT EDITION
-

REFERENCES:
SYSTEM DYNAMICS & CONTROL—Eronini Umez- Eronini THOMSON

Theory Examination:
5. Question paper will comprise of total seven question, each of 20 Marks
6. Question one will be compulsory and based on maximum part of syllabus.
7. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
8. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

CLASS: BE(Mechanical)			Semester:- VIII
SUBJECT: **AUTOMOBILE ENGINEERING**			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	--
	Oral Examination	-	--
	Term Work	-	25
	TOTAL		**125**

Sr. No.	Details	Hrs.
Module 01	**Introduction** Classification of automobiles. **Clutch** Details, Requirements of Clutches, Types of Clutches and Clutch materials, Design of clutch, Fluid coupling, Trouble shooting and remedies. **Transmissions** Necessity of gear box, Sliding mesh, Constant mesh, Synchromesh and epicyclic gear box, Overdrives and hydrodynamic torque converter, Trouble shooting and remedies. Drive line: Propeller shafts and universal joints: Types and construction, Different types of universal joints and constant velocity joints. Live axle and differential: Final drive, spiral, bevel, Hypoid and worm drives, Types of live axles, semi, three quarter and full floating axles. Necessity of differential, Conventional and non-slip differential, Trouble shooting and remedies.	08
Module 02	**2.1** Conventional and non-slip differential, Trouble shooting and remedies. **Brakes** Requirement of brake, Classification of brakes, Mechanical, Hydraulic, Pneumatic, Electro and vaccum brakes. Disc brakes, Braking of front wheel, Rear wheel and four wheel brakes, Brake trouble shooting. Introduction to antilock braking system (ABS). **Steering and Front axles** Steering geometry, Steering requirements, Steering linkages and steering gears, over steer and under steer, Cornering power, Reversibility of steering gears, Types of front axles and their constructions. Trouble shooting and remedies.	08

Module 03	**3. Suspension** Objects of suspension, Basic requirements, Springs- Leaf and Coil springs, Air suspension and its features, Independent suspension, Forces acting in independent suspension, Sprung and un-sprung mass, Pitching, rolling and bouncing, Shock absorbers. **Wheels and Tyres** Requirements of wheels and tyres, Constructional features, Types of tyres, Inflation Pressure and its importance, Application to ride and stability, Trouble shooting and remedies.	08
Module 04	**4. Electrical system** Battery: Types of battery, Lead-Acid, Alkaline,ZEBRA, Sodium Sulphur and Swing, Ratings, charging, Maintenance and testing of Lead-Acid battery. Electronic Ignition System: Capacitor Discharge Ignition System, Distributor less ignition System, Direct Ignition system. Hall effect pulse generator, Inductive pulse generator, Constant dwell system, Constant energy system. Charging System: Dynamo: Principle of operation, Construction, Working, Regulators, combined current and voltage regulator, etc. Alternator: Principle of operation, Construction, Working, Rectification from AC to DC. Starting system: Requirements, Various torque terms used, Starter motor drives; Bendix, Follo through, Barrel, Rubber compression, Compression Spring, Friction Clutch, Overrunning Clutch, Dyer. Starter motor solenoids and switches, Glow plugs.	08
Module 05	**5. Body Engineering** Importance of Body design, Materials for body construction-Styling forms-Coach and bus body style, layouts of passenger cars, Bus and truck bodies. Aerodynamic drag- Aerodynamic lifts and pitching moments, Side force, Yawing moments and rolling moments. Basic dimensions: Geometrical relations to drivers seat, Dimensions of foot and pedal control, Passenger seats, Vehicle dimensions and visibility. Overall Criteria for vehicle comparison. Chassis types and structure types: Open, Semi integral and integral bus structure. Frames: functions and types of frames, Loads on frames, Load distribution of structure, Location of power plant.	10

Module 06	**6. Recent trends in Automobiles** Electronic Control module (ECM), operating modes of ECM (closed loop and open loop) Inputs required and output signals from ECM, Electronic Spark control, Air Management system, Idle speed control. Multipoint fuel injection system and single point fuel injection. Electronic fuel injectors. Principle of operation, Construction, working & application of temperature sensors, inductive sensors, Position sensors(rotary, linear), Pressure sensors, Knock sensors, Hot wire and thin film air flow sensors, vortex flow/turbine fluid sensors, Optical sensor, Oxygen sensors, Light sensors, methanol sensors Rain sensor, New developments in the sensor technology.	08

List of Experiments:

Assignments and laboratory experiments of (any Eight)

1. Study of engine components
2. Study of clutches
3. Study of gear boxes
4. Study of rear axle and differential
5. Study of ignition and charging systems
6. Study of starting systems, lighting systems and battery.
7. Study of brakes
8. Study of suspension system
9. Study of basic dimension and vehicle layout
10. Study of computer control engine

Report on factory visit

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

Term work shall consist of minimum **08** experiments, assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Automotive Mechanics by William Cruose
2. Automotive Mechanics by Joseph Heitner
3. The Automobile Engineering by T.R.Banga & Nathu Singh
4. The Automobile by Harbans Singh Reyat

References:

1. Automobile Engineering by Kirpal Singh Vol I & II
2. Automobile Electrical and Electronics by Tom Denton
3. Vehicle Body Engineering by J Powlowski
4. Computerised Engine Control by Dick King
5. System Approach to Automobile Technology, Jack Erjavec Cengage Learning
6. Light & Heavy Vehical technology, M. J. Nunney , Elsevier

CLASS: BE (Mechanical)			Semester:-VIII
SUBJECT: **FINITE ELEMENT ANALYSIS**			
Periods per week. 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	04	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	1.1 Introductory Concepts: Introduction to FEM. Brief History. General FEM procedure. Applications of FEM in various fields. Advantages and disadvantages of FEM. 1.2 Differential Equations in different fields : Types of Differential Equations. Primary and Secondary Variables and types of Boundary Conditions. 1.3 Matrix Algebra: Matrix operations, Gauss Elimination Method to get inverse of a Matrix. Partitioning of Matrix. 1.4 Numerical Integration: Trapezoidal rule, simpson's $1/3^{rd}$ rule, Newton cotes formula, Gauss quadranture formula, Gauss quadranture in two dimensions.	6
Module 02	2.1 Approximate solution of differential equations-- Weightaed residual techniques, collocation, Least squares and Galerkin methods. 2.2 FEM Procedure : Definitions of various terms used in FEM like element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables, essential boundary conditions, natural boundary conditions, homogeneous and non-homogeneous boundary conditions.	7
Module 03	3.1 Minimization of a functional. Principle of minimum total potential. Piecewise Rayleigh-Ritz method. Comparison with weighted residual method. 3.2 Piecewise approximations. Basis of Finite Element Methods. Formulation of matrix method--"stiffness matrix"; transformation and assembly concepts.	8
Module 04	4.1 Example problems in one dimensional structural analysis, heat transfer and fluid flow (Stepped and Taper Bars, Fins, Fluid Network, Spring-Cart systems, Plane Trusses, Beams). 4.2 Elements of variational calculus. Band-width, aspect ratio, coarse and fine meshing, etc..	9
Module 05	5.1 Two dimensional finite element formulations. Introduction, Three nodded triangular element, four nodded rectangular element, six nodded triangular element, compatibility, four nodded quadrilateral element, eight nodded quadrilateral element, nine nodded	11

	quadrilateral element. 5.2 Natural coordinates and coordinate transformations: Alternate methods for deriving shape functions, Natural coordinates – quadrilateral elements, Natural coordinates – triangular elements. 5.3 Isoperimetric. Algorithms for solution of equations. Convergence criterion, patch test and errors in finite element analysis. Method of Elimination. Sources of error.	
Module 06	6.1 Finite element formulation of dynamics. Applications to free vibration problems. Lumped and consistent mass matrices. Algorithms for solution of Eigen value problems. Transient dynamics problems in heat transfer and solid mechanics.	7

List of Experiments:

At list three exercises from the following areas.

1) Structural analysis
2) Thermal analysis.
3) Fluid dynamics.
4) Mechanical vibrations
5) Coupled field/ multiphysics

Each exercise shall cover tasks like Model-preparation, Mesh generation, Simulation, Post-processing etc. in any analysis software such as ANSYS, NASTRAN, ABACUSS etc.
Students shall attach the solution of above exercise as part of term work.

Course Project

In course project students shall integrate and apply the knowledge gained during the fundamental courses of Mechanical Engineering. The projects will be developed by teams of maximum two students (using any analysis software) and shall consist problem definition, model preparation, appropriate selection of elements, mesh generation, post processing, simulation and validation of results.

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of syllabus.

Term Work:

Term work shall consist of minimum **03** experiments, assignments (one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (exercises/assignments): …….. (10) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books: .

1) The Finite Element Method its Basis & Fundamentals –O.C.Zienkiewicz, R.L.Taylor & J.Z.Zhu, *Butterworth-Heinemann, Elsevier*
2) Finite Element Method, Reddy J. N., *McGrawHill*
3) The Finite Element Method in Engineering , 4th Edition, S.S.Rao, *Academic Press, Elsevier*
4) Finite Element Methods for Engineers, U.S.Dixit, *Cengage Learning*
5) Textbook of FE Analysis, P.Seshu, *Prentice Hall*
6) Introduction to Finite Elements Methods by Desai and Abel, *CBS Publication.*
7) Introduction to Finite Elements in Engineering by Tirupati R. Chandrupatla & Ashok D.Belegundu.

References:

1) Introduction to Finite Element Methods by Erik Thompson, Wiley India.
2) Finite Elements Hand Book by H. Kardestuneer.
3) Concepts & Applications of Finite Element Analysis by R.D.Cook.
4) Bathe, K.J., Finite Element Procedures in Engineering Analysis, *Prentice Hall of India.*
5) Huebener K.H., Dewhirst D.D., Smith D.E. and Byrom T.G., The Finite Element Method for Engineers, John Wiley, New York.
6) Finite Element Methods ,Logan, *Cengage Learning*
8) Finite Elements Analysis , George Buchanan *McGrawHill*
9) Finite Elements Analysis , C.S.Krishnamoorthy, *Tata McGrawHill*
10) Concept and Application of Finite Element Methods by Robert Cook, Wiley India.

CLASS: BE(Mechanical)			Semester:-VIII
SUBJECT: **INDUDTRIAL ENGINEERING AND ENETERPRISE RESOURSE PLANNING**			
Periods per week. 1Period of 60 min.	Lecture	04	
	Practical	--	
	Tutorial	02	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical		--
	Oral Examination		--
	Term Work		25
	TOTAL		**125**

Sr. No.	Details	Hrs.
Module 01	I INDUSTRIAL ENGINEERING 1. INTRODUCTION Introduction to industrial engineering, history and contribution to industrial engineering, industrial engineering approach, techniques of industrial engineering, objectives of industrial engineering, system approach and industrial engineering, definition and concept of productivity, productivity measures, factors influencing productivity, productivity improvement techniques.	6
Module 02	2. WORK STUDY & ERGONOMICS Work Study: Definition and objectives, importance and advantages, work study procedure. Method Study: Definition and objectives, scope and steps involved in method study, job selection, recording techniques, critical examination, development and selection of improved method, motion economy principles, installation and maintenance of proposed method. Work Measurement: Definition and objectives, techniques of work measurement, steps involved in work measurement, types of elements, time study equipments, performance rating and allowances, computation of standard time, predetermined motion time standards(PMTS) Ergonomics: Definition and objectives of human engineering, man-machine systems and their aspects and relationship with productivity, human factors affected by environment, methods to improve work environment. **Evaluation of cultural fit on mergers and acquisitions of business enterprises.**	8
Module 03	3. VALUE ENGINEENEERING Definition and meaning of Value engineering, value analysis and value engineering, use of value engineering, steps in value engineering, principles of value engineering.	8

Module 04	4. RESOURCE UTILIZATION Inventory Management: Definition, scope and objectives, economics of inventory management, deterministic models in inventory management Facility Planning: Objectives and scope, location of facilities, types of layouts, layout design techniques, assembly line balancing, and computer packages for layout analysis. Statistical Quality Control: Cost of quality, quality specification, need of SQC, Concept of variation, central tendency theorem, acceptance sampling, control charts for variables, control charts for attributes, TQM. WASTE MANAGEMENT - Definition and objectives, types of wastes, waste and productivity, waste and environment, waste reduction techniques, JIT for waste reduction.	9
Module 05	5. COMPUTERS IN INDUSTRIAL ENGINEERING Need of computers in industrial engineering, development of integrated systems, sharing of data and information, advantages of integrated systems, principles of integrated system design, Introduction to MRP-I, MRP-II, JIT, BPR, SCM, EPR, Lean manufacturing , Agile manufacturing, etc.	8
Module 06	6. ENTERPRISE RESOURCE PLANNING ERP- Conceptual overview, Critical components, Structure, Evolution and Architecture of ERP, Best Practices and Business process reengineering issues in ERP, ERP- Overview of functional modules (i) Manufacturing and Purchase Module: A functional overview (ii) Finance Module-A functional overview (iii) Sales & Distribution Module-A functional Overview ERP-Implementation methodologies, Success and failure cases, ERP Audit, Future of ERP, ERP systems in India, Introduction to ERP software. SAP/3.0 : Technical module and functional module, ABAP and BASIS as technical module, Production planning, material management, sales and distribution, finance and controlling, plant maintenance , quality management, etc 11 modules in functional module. **Information technology and ERP systems in Mergers & Acquisitions of business enterprises, post merger and ERP systems**	9

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

At least six assignments on concepts, Case studies and analysis based on the topics mentioned above. Any two shall be on EXCEL sheet

Term work shall consist of minimum **06** assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (Assignments/Case studies): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Management A Global Perspective , 10th Edition, Heinz Weihrich, Harold, Koontz, *Tata McGraw Hill Publishing Company Ltd ,International Edition.*
2. Production and Operation Management, Chase, Acquilano & Jacks, *Tata McGraw Hill Publishing Company Ltd*
3 Time and Motion Study, Ralph M. Barnes.
4 Total Quality management, J.S. Oakland
5 Work Study and Ergonomics, H.S. Sham , *Dhanpatrai & Sons*
6 ERP and beyond integrating your entire organization, Gang A. LangenWalter, The St. Lucas Press/ Apics Series on resources management
7. Enterprise Resource Planning, Alexis Leon, *Tata McGraw Hill Publishing Company Ltd*

Journal Reference
Yaakov Weber, Ehud Menipaz, Measuring cultural fit in mergers and acquisitions, International Journal of Business Performance Management 2003 - Vol. 5, No.1 pp. 54-72

References:

1. E- Business & ERP Transforming the Enterprise Grant Norris , James R. Hurley , Kenneth M. Hurtley , John R. D., John D. B.,Wiley
2. Plant layout, Facilities planning By M. Apple
3. TQM (Total Quality management) By Besterfield
4. Business process reengineering Myths & Realities By Colen Coulsan , *Thomson press*
5. Busi ness Process redesign A View From the inside By Ashley , Bragenza, Andrew Myers, *International Thomson Business Press*
6. ERP, Singla, Cengage Learning.

CLASS: BE (Mechanical)			Semester:-VIII
SUBJECT: **BUSINESS PROCESS REENGINEERING (ELECTIVE II)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	---	---
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	1.1What is BPR 1.2Considerations in BPR 1.3 TQM 1.4 SW available for BPR	5
Module 02	2.1 How to Plan Your Project, .Select the Right Team, and Choose Your Approach 2.2 Articulate the business issues driving the project 2.3 Clearly define your project's objectives	8
Module 03	3.1Gain buy-in from key business leaders 3.2 Define the project scope 3.3 Create a powerful team	8
Module 04	4.1 Choose your reengineering steps 4.2 Select and work with consultants	8
Module 05	5.1 Prepare a project budget 5.2 Project Planning Template and Guidelines 5.3 Reengineering Team Selection Criteria and Approach	9
Module 06	6.1 Methodology Selection 6.2 Project Readiness Assessment 6.3 Case Studies of BPR	10

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments at least one on each module, two case studies and written test. The distribution of marks for term work shall be as follows:

- Assignments and case studies: …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Reengineering the Corporation - A Manifesto for Business Revolution by M. Hammer and James Champy.
2. Reengineering for Results: Keys to Success from Government Experience Sharon L. Caudle; *National Academy of Public Administration.*
3. The Breakthrough Strategy For Total Quality, Productivity, And Competitiveness James Harrington
4. The Change Management Toolkit for Reengineering
For companies and individuals involved in reengineering and represents a practical approach to the management of change - in any organization - from Holland and Davis, WorthingBrighton Press.
5. Competing for the Future, Gary Hamel and C.K. Prahalad; book review and ordering info.

References:

1. Deming Management Method, The Mary Walton; Perigee, Books, Book review
Best Practices In Reengineering, McGraw-Hill New York, NY, 1995 by David K. Carr and Henry J. Johansson, Coopers and Lybrand
2. Managing the Change Process: A Field Book for Change Agents, Team, Leaders and Reengineering Managers; David K. Carr, Kelvin J, Hard, Wiliiam J. Trahant
3. New Tools For New Times: The Workflow Paradigm, Second Edition, WARIA Book Review on line, http://www.waria.com/waria/fischer.html
4. Process Innovation: Reengineering Work Through Information Technology, Thomas Davenport; Harvard Business School Press
5. Reengineering Revolution, A Handbook (The) HarperCollins - Publishers, Inc. New York, 1995, Michael Hammer and Steven A. Stanton; Book Review Only
6. The Wisdom of Teams: Creating the High-Performance Organization, Jon R. Katzenbach Douglas K. Smith.
7. Winning With Quality: Applying, Quality Principles In Product Development, John W. Wesner, Jeffrey M. Hiatt, and David C. Trimble
8.Business Process Re-Engineering and Change Management by B R Dey, Biztantra Publication.

CLASS: B.E. (Mechanical)		Semester:- VIII	
SUBJECT: **ADVANCED REFRIGERATION & AIR-CONDITIONING (ELECTIVE-II)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	Refrigeration cycles : Concept of SST & SDP pressure drops. Equipments: Compressor-Reciprocating , Centrifugal , rotary screw, Details of rating selection procedure ARI standards, capacity control methods, Condensers & evaporators-Detailed study of various types (for Halocarbon & ammonia applications), Vertical Chiller, tank & coil systems, technical selection, manufacturing details, ASME code & TEMA standards , Evaporator-compressor balance.	8
Module 02	Refrigerant Controls: Electrical, electronic flow control, level control, capillary, TXV's selection and installation , safety and operating controls. Refrigerant : Properties, application, azeotropes,zeotropes,R134a, 142b, ammonia, ozone depletion Montreol protocol, TEWI factors-brines-limitations of usage Cooling Towers: Performance & Selection	8
Module 03	Multistaging-booster, internalling compounded cascading Heat Pumps-Energy conservation, fouling factor double & single bundle condensers. Refrigerant piping-Materials, accessories, suction discharge & liquid line sizing, single & double rises, layout, installation practice & layouts	8
Module 04	**Water Piping:** Condenser, Cooling Tower & Chilled water piping, accessories-installation **Electrical Motors:** Types, selection IS code wiring layout, starter fuses etc. **Vapor absorption system:** Li Br water single & double stage, direct fired, manufacturers, Operation & Practical difficulties.	8
Module 05	Steam ejector System(in brief) **Air conditioning-Psychrometry:** Cooling load estimation for all kinds of application including low RH class room, hospitals, synthetic fibre plants etc.	8
Module 06	**Design of Air-ducts:** Use of ductulator air handling units, selection of fins & blowers, air washers, ISI & SMACNA standards, package units. **Erection of Systems:** Foundation, details placing the system in operation, adjustment & final check, routine & seasonal maintenance, shut down & starting Trouble analysis,	8

	common service operation.	

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of Assignments & reports of visits to refrigeration & air-conditioning installations.

The distribution of marks for term work shall be as follows:

- Laboratory work (Assignments/ report): …… (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: …… (25) Marks.

Text Books:

1. Refrigeration-Principles & Systems-Edward G. Pita, *John Wiley & Sons*.

2. Refrigeration & Air Conditioning-W.L.Stocche & J.W.Jons, *McGraw Hill Pvt. Ltd.*

3. Air Conditioning Principles & Systemsd-Edward G. Pita, *John Wiley & sons*

4.Refrigeration & Air Conditioning-C.P.Arora , Tata *McGraw Hill.*

5.Heating , Ventilating and Air Conditionng by Faye C. Mcquistton, Wiley India

References

1. Principles of Referigeration-Roy Dossat, *Wiley Estern ltd*.

CLASS: BE(Mechanical)			Semester: VIII
SUBJECT: **Nuclear Technology -II (Elective –II)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination	--	25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 1	**1. Recapitulations**: Atomic Structure; radioactivity; interaction of alpha, beta and gamma with matters; neutron reactions – fission and fusion energies; fission fertile and fissionable material, neutron reactions, neutron cross sections, fission process, fission products, fast neutron diffusion and slowing down of neutrons, moderating ratio, thermal neutrons, four factor formula, criticality equation, non-leakage probability, reflector, neutron lifetime, period, delayed neutron, positive and negative reactivity, temperature, power and void coefficients of reactivity, effect of isotopic purity of moderator, changes of coolant parameters on reactivity effects, advances in nuclear power reactors, different types of power reactors, secondary steam and with reheat and feed water heating, emergency power supply, power generation and distribution, dedicated power supply and power evacuation arrangements, principles of radiation protection, radioactive waste management, different uses of nuclear energy- research, test, isotope productions, agricultural, medicinal and industrial, regulatory aspect on the use of nuclear energy, nuclear energy scenario India.	4
Module 02	**2.0. Systems in nuclear reactor**: 2.1: Reactor fuels: Natural and enriched fuels, sources, merits and demerits of different fuels for reactor use, fabrication, handling of fuels and irradiated fuels, fuel management, storage, reprocessing of irradiated fuels. 2.2: Reactor shutdown systems: Materials for reactor control and choices, liquid vs. solid shut down systems, design aspect- fall safe features, loading consideration, actuation methodology, 2.3: Primary heat transport (cooling) system: Heat generation and distribution, Coolant characteristics, Selection of coolants, Coolant Circuit, Core thermal hydraulics, design aspects, radioactivity generation. 2.4: Decay heat removal system:	12

	Functional requirements, Cooling circuits, Design aspects, Loading considerations, Passive features. 2.5: Reactor structure: Core composition, Reflector, Reactor vessel, Safety vessel, Shielding – thermal, biological, Shield cooling system, Neutron flux monitoring and control, instrumentations, 2.6: Moderator system: Materials, Selection, Design consideration, Circuit, Radioactivity aspects. 2.7: Cover gas system: Purpose, Selection of material, Design considerations, Circuit. 2.8: Reactor regulating system: Purpose, Methodology, Design considerations, Actuating mechanism 2.9: Auxiliary cooling circuit: Functions, Design considerations, cooling circuit 2.10: Containment and ventilation system: Functions, Types, Arrangement, Design considerations, loading , Testing 2.11 Conventional systems: Function, Design considerations and Arrangement for: (1) Secondary steam system: Boiler (generator) – Steam discharge and dump valves, Turbine, reheat, feed water heating; Condenser; Condenser cooling water system, polishing unit, Deaerator. (2) NDCT, IDCT, intake from and outfall to natural water source. (3) Electrical power supply: Classification of power, Emergency D.G. power supply system, Batteries, Generators, Switchyard, Transmission, Dedicated power source and evacuation systems. (4) Air conditioning (5) Control and instrumentation: Parameters and logics for reactor scram, Power regulation, Monitoring, display and recording systems, Main control room and Supplementary control room.	
Module 03	**3.0: Reactor Design:** Principles, Safety classifications, Seismic quality group, Loading considerations under normal operations, anticipated operational occurrences, design basis accidents such as earthquake, loss of coolant accident (LOCA),blackout, flood, missiles, operator error, duel failures as applicable, Safety features for server accidents, standards, software's ,verifications etc.	8
Module 4	**4.0: Nuclear power plants**: 4.1: Types –Thermal reactors: BWR, PWR, PHWR, GCR, APWR, AHWR etc. Fast reactors – Breeders; Fusion power; Off-land NPPs:- space power unit, nuclear ships, submarines 4.2: Economies of NPPs: Various costs, ROI, Sizing, Operational characteristics, Tariff	8

Module 05	**5.0 Radiation protection and**: **Radioactive Waste Management (details):** 5.1 Radiation protection: Radiation hazard, Exposures, Exposure pathways, dose unit, measurement, radiation protection – CRP and other guidance document etc. 5.2 Radioactive Waste Management: Waste categorization, Generation, Handling of wastes – liquid, gaseous and solid, Short term / long term storage / disposed.	8
Module 06	**6.0 Reactor Stages and Safety Assurances:** 6.1 Reactor Stages: 1 Site Selection 2 Reactor construction and commissioning: 3 Operation and maintenance: Technical specifications for plant operations, Manrem budgeting and control, scheduled and unscheduled maintenance, Plant modifications, refurbishments. 4 Plant life extension program 5 Plant decommissioning: 6.2:Nuclear safety assurance: 1 safety commitment by the utility. 2 Nuclear safety regulation: national body and International advising body (IAEA – International atomic energy agency under U.N.) 3 Nuclear safety documents: standards / codes, guides, manual, safety series, technical documents. 4 Regulatory consents for site selection, design, construction, stage wise commissioning from first criticality to commercial operations. 5 Periodic safety reviews , safety reviews for relicensing / reauthorization for operation. 6 safety analysis: deterministic safety assessment, probabilistic safety assessment (PSA), regulating inspection and enforcement. 7 A retrospect in nuclear reactor accidents world over: root causes, lessons learnt, subsequent improvements in design and operations to prevent recurrence. 8 Plant performance records and reports, living PSA / risk monitors. 9 Public Awareness, public participation in granting regulatory consent to nuclear plant.	8

List of Experiments:

Atleast 10 assignments and study projects based on above syllabus

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:
Oral examination will be based on maximum portion of the syllabus

Term Work:
Term work shall consist of minimum **10** assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

4. NPP of Power Plant Engg- A.K. Raja, A.P. Srivastava & M. Dwivedi
5. An Introduction on Nuclear Engineering, A course in Power Plant Engg- Arora & Domkundwar
6. Nuclear Power Plant, Power Plant Engg. (Steam & Nuclear)- P.K. Nag.

Reference Book:

1. Nuclear Engineering- Glasstone & Sesons

CLASS: BE (Mechanical)			Semester:-VIII
SUBJECT: **INTRODUCTION TO NANOTECHNOLOGY (ELECTIVE II)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical		---
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	Basic Solid State Physics-Crystal structures, size dependence of properties, semiconductors, energy bands, excitons.	6
Module 02	Measurement of properties-particle size, TEM, SEM, STM, AFM, Spectroscopy and magnetic resonance Properties of individual nanoparticles – Metal nanocrystals, magic numbers and theoretical modeling, geometric structure, semiconducting nanoparticles, carbon nanoparticles.	9
Module 03	Synthesis and characterization Bulk nanocrystals- synthesis methods thin film deposition, multilayers, magnetic nanoparticles, spin valve, giant and colossal magnetoresistance, ferrofluids Quantum wells, wires and dots –	8
Module 04	Carbon nanostructures, carbon molecules, carbon clusters, carbon nanotubes: Fabrication, structure, Electrical properties, vibration properties, Mechanical properties. Apllication of carbon Nanotubes; Field emission and shielding, Computers, Fuel cells, Chemical sensors, Catalysis, Mechanical Reinforcement.	9
Module 05	Organic compounds and polymers-forming and characterization, size effects, supramolecules, micelles Biological materials –biological building blocks, DNA double nanowire, genetic code, biological nanostructures (proteins, miscelles and vescilles), multilayer films,	8
Module 06	MEMS, NEMS – design, fabrication and applications. (Nanostereolithography, Plasma CVD), coating of nanoparticles.	9

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:
Oral examination will be on maximum portion of the syllabus.

Term Work:

At least six assignments (at least one on each topic), seminar and class test.
The distribution of marks for term work shall be as follows:

- Laboratory work (Assignments/Seminar): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Charles P Poole Jr. and Frank J Owens, Introduction to Nanotechnology, *Wiley*
2. Hari Singh Nalwa (Editor), Nanostructured Materials & Nanotechnology Concise Edition, *Academic.*
3. William A Goddard, Donald W Brenner, Sergey Edward Lyshevski, Goddard III, Handbook of Nanoscience, Engineering, and Technology *CRC Press.*
4. Peyghambrain., S.W. Koch and A. Mysyrowicz, Introduction to Semiconductor Optics, *Prentice Hall.*
5. S.V. Gaponenko., Optical Properties of Semiconductor Nanocrystals, *Cambridge Univeristy Press.*
6. David Sellmyer and R Skomski Ed., Advanced magnetic nanostructures, *Springer.*
7. Gabriel O Shonaike, Suresh G Advani, Advanced Polymeric Materials *CRC Press.*

References:

1. T. Pradeep, Nano: The essentials Understanding Nanoscience and Nanotechnology, *Tata McGraw Hill.*
2. Nanotechnology, Lynn Foster, Pearson Education

CLASS: BE(Mechanical / Automobile)			Semester:- VIII
SUBJECT: **NON-CONVENTIONAL ENERGY SOURCES**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**1. ENERGY REQUIREMENT - OF INDIA AND WORLD :** Present energy scenario, conventional energy sources- World's production and reserves, India's production and reserves. Global energy crises, shortcomings and limitations to the existing energy sources, need for alternative energy sources.	6
Module 02	**SOLAR ENERGY:** Solar radiation- Terrestrial and extra terrestrial, extra instruments. Energy potential of sun, simple flat plate collector, design of liquid flat plate collector, selective coatings, Application of LFPC performance, analysis of LFPC. Concentrating collectors, solar ponds, solar distillators, solar satellite power system, solar cooker, solar air heaters, solar driers, photovoltaic direct energy conversion, solar cells, solar thermal power system, solar energy storage. **HYDRO-POWER:** Principle of hydro-power- prospects of small hydropower, mini and micro power systems, hydropower conversion devices-Turbine, status in India.	10
Module 03	**WIND ENERGY:** History, principle of wind power, Betz model, wind mills- horizontal axis and vertical axis, horizontal axis wind turbines, their components. Operation, recent developments and their site characteristics. Vertical axis- Magnus effect, Madaras & Darrieus turbine. Application of wind energy.	7
Module 04	**GEOTHERMAL ENERGY:** History and future, origin and types of geothermal energy regions, dry rock and hot Acquifier analysis, vapor dominated and liquid nominated geothermal systems, operational and environmental problems.	7
Module 05	**OCEAN ENERGY:** Types of ocean energy sources, Ocean temperature difference, OTEC cycles-closed and open. Comparison with normal thermal power cycles. Ocean waves-Wave motion, Energy power from waves, Wave energy conversion	9

	devices. Tidal Power-Formation and causes of tides, power from tides, Tidal power devices.	
Module 06	**BIOMASS ENERGY:** Various forms of biomass as a potential energy source, energy plantation, Bio-fuel production processes, Biogas plants, Gassifiers, principle, construction and design of gassifiers, individual and community bio and gobar gas plants, Types of gobar gas plants. **CHEMICAL ENERGY SOURCES:** Fuel cells-principle, classification, advantage and disadvantage, application and recent development	9

Theory Examination:

5. Question paper will comprise of total seven question, each of 20 Marks
6. Question one will be compulsory and based on maximum part of syllabus.
7. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
8. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: …… (25) Marks.

Text Books:

1. Renewable Energy Sources - John W. Twidell & Anthony D. Weir. ELBS Pub.
2. Non-Conventional energy sources - G.D. Rai

References:

1. Solar Energy - Principle of thermal collection and Storage -- S.P. Sukhatme, J.K. Nayak Tata McGraw Hill
2. Solar Energy, Fundamentals and Applications, Garg, Prakash, Tata McGraw Hill

CLASS: BE(Mechanical / Automobile)			Semester:- VIII
SUBJECT: **Project Management**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	Projects in Contemporary Organization, project initiation, Strategic Management and Project Selection, The Project Manager, Project Organization, Project Planning, Conflict and Negotiation., project implementation, Budgeting and Cost Estimation., Scheduling, Resource Allocation, Monitoring and Information Systems, Project Control, Project termination, Project Auditing, Project Termination	8
Module 02	project risk – scope Project management – definitions – overview – project plan – management principles applied to project management – project management life cycles and uncertainty	8
Module 03	Project planning – scope – problem statement – project goals – objectives – success criteria – assumptions – risks – obstacles – approval process – projects and strategic planning	8
Module 04	Project implementation – project resource requirements – types of resources – men – materials – finance Project monitoring – evaluation – control – project network technique – planning for monitoring and evaluation – project audits – project management information system	8
Module 05	project scheduling – PERT & CPM – Project inventory management – nature of project inventory – supply and transportation of materials. project communication – post project reviews Project team management – recruitment – organizing – human resources – team operating rules – project organization – various forms of project organizations, project organization charting	8
Module 06	project contracts – principles – compilation of contracts – practical aspects – legal aspects – global tender, negotiations – insurance , Closing the project – types of project termination – strategic implications project in trouble, termination	8

	strategies, evaluation of termination possibilities – termination procedures	

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Jack Meredith, Project Management 6th edition, wileyIndia
2. Project Management – for 21st Centrury-Beenet P Lientz, Kathyn Prea- Academic Press, 1995
3. Project Management –Denislok
4. Project Management- Gido Clements, Cengage Learning

Reference books:

1. Project management,David I Cleland, McGrawHill International Edition, 1999
2. Project Management – Gopalakrishnan – Mcmillan India Ltd.
3. Project Management-Harry-Maylor-Peason Publication
4. Project Management- Jeffrey Pinto, Peason Publication
5. Contemporary Project Management, Timothy Kloppenborg, Cengage Learning.
6. Project Management Core text Book by Gopalan, Wiley India.

CLASS: BE(Mechanical / Automobile)			Semester:- VIII
SUBJECT: **Product Life cycle Management**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	Introduction to PLM Need for PLM, opportunities and benefits of PLM, different views of PLM, components of PLM, phases of PLM, PLM feasibility study, PLM visioning.	4
Module 02	PLM Strategies Industrial strategies, strategy elements, its identification, selection and implementation, change management for PLM Product Data Management (PDM) PDM systems and importance, reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	7
Module 03	5. Product Design Engineering design, organization and decomposition in product design, product design process, methodical evolution in product design, concurrent engineering, design for 'X' and design central development model. Strategies for recovery at end of life, recycling, human factors in product design. Modeling and simulation in product design 5. New Product Development Structuring new product development, building decision support system, Estimating market opportunities for new product, new product financial control, implementing new product development, market entry decision, launching and tracking new product program. Concept of redesign of product	12
Module 04	6. Technology Forecasting Future mapping, invocating rates of technological change, methods of technology forecasting such as relevance trees, morphological methods and mission flow diagram, combining forecast of different technologies,	9

	uses in manufacture alternative	
Module 05	Integration of technological product innovation and product development in business processes within enterprises, methods and tools in the innovation process according to the situation, methods and tools in the innovation process according to the situation Virtual product development tools for components, machines, and manufacturing plants: 3D CAD systems, digital mock-up, model building, model analysis, production (process) planning, and product data technology	9
Module 06	Product conception process: Business processes, data-process relationship, from the idea to waste disposal Product structures: Variant management, product configuration, material master data, product description data, Data models, Life cycles of individual items, status of items	7

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments (at least one on each module) and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Stark, John. *Product Lifecycle Management: Paradigm for 21st Century Product Realisation*, Springer-Verlag, 2004. ISBN 1852338105
2. Fabio Giudice, Guido La Rosa, Product Design for the environment-A life cycle approach, Taylor & Francis 2006
3. 3. Saaksvuori Antti / Immonen Anselmie, product Life Cycle Management Springer,Dreamtech,3-540-25731-4
4. *Product Lifecycle Management, Michael Grieves, Tata McGraw Hill*

CLASS: B.E. (Mechanical)			Semester:- VIII
SUBJECT: **ARTIFICIAL AND MACHINE INTELLIGENCE, Elective II**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	**1. AI AND INTERNAL REPRESENTATION:** Artificial Intelligence and the World, Representation in AI, Properties of Internal Representation, The Predicate Calculus, Predicates and Arguments, Connectives Variables and Quantification, How to Use the Predicate Calculus, Other Kinds of Inference Indexing, Pointers and Alternative Notations, Indexing, The Isa Hierarchy Slot-Assertion Notation, Frame Notation	08
Module 02	**2. LISPS:** Lisps, Typing at Lisp, Defining Programs, Basic Flow of Control in Lisp, Lisp Style, Atoms and Lists, Basic Debugging, Building Up List Structure, More on Predicates, Properties, Pointers, Cell Notation and the Internals (Almost) of Lisp, Destructive Modification of Lists, The for Function, Recursion, Scope of Variables Input/Output, Macros.	08
Module 03	**3. NEURAL NETWORKS AND FUZZY SYSTEMS:** Neural and fuzzy machine Intelligence, Fuzziness as Multivalence, The Dynamical Systems approach to Machine Intelligence, The brain as a dynamical system, Neural and fuzzy systems as function Estimators, Neural Networks as trainable Dynamical system, Fuzzy systems and applications, Intelligent behavior as Adaptive Model free Estimation, Generalization and creativity, Learning as change, Symbol Vs Numbers, Rules Vs Principles, Expert system Knowledge as rule trees, Symbolic	08

	Vs Numeric Processing, Fuzzy systems as Structured Numerical estimators, Generating Fuzzy rules with product space Clustering, Fuzzy Systems as Parallel associators, Fuzzy systems as Principle based Systems.	
Module 04	**1. NEURAL NETWORK THEORY:** Neuronal Dynamics: Activations and signals, Neurons as functions, signal monotonicity, Biological Activations and signals, Neuron Fields, Neuron Dynamical Systems, Common signal functions, Pulse-Coded Signal functions	08
Module 05	**2. GENETIC ALGORITHMS:** A simple genetic algorithm, A simulation by hands, similarity templates(Schemata), Mathematical foundations, Schema Processing at work, The two- armed and k- armed Bandit Problem, The building block hypothesis, The minimal Deceptive Problem Computer implementation of Genetic algorithm, Data Structures, Reproduction, Cross over and Mutation. Time to reproduce and time to Cross Mapping objective function to fitness, form, Fitness scaling. Applications of genetic algorithm, De Jong and Function Optimization, Improvement in basic techniques, Introduction to Genetics based machine learning, applications of genetic based machine leaning.	08
Module 06	**3. DATA MINING:** Introduction to Data Mining, Computer systems that can learn, Machine learning and methodology of science, Concept learning, Data ware house, designing decision support systems, Client server and data warehousing, Knowledge Discovery Process, Visualization Techniques, K- nearest neighbor, Decision tree, OLAP tools, Neural networks, Genetic algorithm, Setting up a KDD environment, Real life applications, Customer profiling, Discovering foreign key relationships	08

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of:

a) Software development in lisp and other languages and packages for practices and algorithm
discussed in the syllabus. .

b) Written assignment on any four topics discussed above

c) One seminar by every student from the aforesaid area.

d) One class test

The distribution of marks for term work shall be as follows:

- Laboratory work (Assignments/Seminar): …… (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: …… (25) Marks.

Text Books:

1. Introduction to Artificial intelligence By Eugene Charniak, Drew McDermott Addison Wesley
2. Neural Networks and fuzzy systems A dynamical systems approach to machine Intelligence
by Bart Kosko- PHI
3. Genetic Algorithms in search, Optimization & Machine Learning by David E Goldberg- Addison wesley
4. Data Mining by Pieter Adriaans and Dolt Zantinge - Pearson Education Asia
5. Data Warehousing in the Real World by Sam Anahory and Dennis Murray.
6. Artificial Intelligence, Elaine Rich, Kevin Knight, S. Nair, *McGraw Hill Publishing Company Ltd*

Reference:

1. Industrial Robotics, Mikell Groover, Mitchell Weiss, Nagel, Odrey, *Tata McGraw Hill Publishing Company Ltd*
2. Artificial Intelligence, Michael Negnevitsky, *Tata McGraw Hill Publishing Company Ltd*
3. Intelligence, Patrick Winston, *Tata McGraw Hill Publishing Company Ltd*
4. Artificial Intelligence, Stuart Russell, Peter Norvig, *Tata McGraw Hill Publishing Company Ltd*

CLASS: BE(Mechanical)			Semester:- VIII
SUBJECT: **Advanced Turbo Machinery**			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical		--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**1. Principles of Turbo machinery** 1.1 Introduction, Overview and Machinery Classification 1.2 Review of Conservation Laws 1.3 Dimensional Analysis and Scaling Laws 1.4 Adiabatic flow through Nozzles and Diffusers 1.5 Work and Efficiencies in Compressor Stages 1.6 Selection of centrifugal, axial, mixed flow, Axial flow machines based on specific Speed	8
Module 02	**2. Flow Through Cascades** 2.1 Two-dimensional Flow 2.2 Cascade of Blades 2.3 Cascade Tunnel 2.4 Axial Turbine Cascades 2.5 Axial Compressor Cascades	8
Module 03	**3. Analysis of Axial Turbine Stage** 3.1 Stage Velocity triangles 3.2 Single Impulse Stage 3.3 Multi-stage velocity and Pressure Compounded Impulse 3.4 Reaction Stages 3.5 Losses and Efficiencies 3.6 Performance Charts	8
Module 04	**4. Analysis of Centrifugal Blower** 4.1 Theoretical Characteristic Curves 4.2 Euler Characteristics and Euler Velocity Triangles 4.3 Losses and Efficiencies 4.4 Flow through impeller Casing, inlet Nozzle, Volute, Diffusers 4.5 Multi-vane Impellers of Impulse Type 4.6 Cross flow Fans	8
Module 05	**Testing and Control of Fans** Fan Testing, Noise Control, Materials and Components Blower	8

	Regulation, Speed Control, Throttling Control at Discharge and Inlet.	
Module 06	**Design and Application of Blowers** Special Design and Applications of Blower, Induced and Forced Draft Fans for Airconditioning Plants, Cooling Towers, Ventilation Systems, Booster Sytems.	8

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum **06** assignments and written test. The distribution of marks for term work shall be as follows:

- Assignments/Tutorials……. …….. (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: …… (25) Marks.

References:

1. Stepanoff A.J. Turboblowers, John Wiley & sons, 1970.
2. Brunoeck, Fans, Pergamon Press, 1973.
3. Austin H. Chruch, Centrifugal pumps and blowers, John wiley and Sons, 1980.
4. S.L. Dixon, Fluid Mechanics, Thermodynamics of turbomachinery , Elsevier
5 .S.L. Dixon. Worked examples in turbomachinery, Pergamon Press, 1984.
6 S M Yahya, Turbines, Compressors and Fans, Tata McGraw Hill Publishing Company Ltd. 1983
7. http://www.petropager.com
8. http://www.tami.org
9. http://www.erichson.com
10. http://www.apgate.com

CLASS: B.E. (Mechanical)			Semester:- VIII
SUBJECT: **Mechanical System Design (ELECTIVE II)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	04	100
	Practical	--	---
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		150

Sr. No.	Details	Hrs.
Module 01	**Design Of Cylinders and pressure vessels :-** Thick and thin cylinders – Thin cylindrical and spherical vessels – Lame's equation – Clavarino's and Birnie's equations – Design of hydraulic and pneumatic cylinders – Auto frettage and compound cylinders – Gasketed joints in cylindrical vessels. Modes of failures in pressure vessels. Unfired pressure vessels – Classification of pressure vessels as per I. S. 2825 – categories and types of welded joints – weld joint efficiency – Corrosion, erosion and protection vessels, stresses induced in pressure vessels, materials of construction. Thickness of cylindrical and spherical shells and design of end closures as per code – Nozzles and Openings in pressure vessels – Reinforcement of openings in shell and end closures. Area compensation method – Types of vessel supports	10
Module 02	**Optimum design :-** Objectives of optimum design –Johnson's Method of Optimum Design (MOD). Adequate and optimum design. Primary, subsidiary and limit equations – Optimum design with normal specifications of simple machine elements like tension bar, transmission shaft, helical spring.– Introduction to optimum design with redundant specifications.	08
Module 03	**Design of Flypress :-** Power calculation for fly press, Design of flywheel, Fundamental equation of motion – torque analysis – disk and rimmed flywheels – Stresses in flywheel rim and spokes – Design of disc and rimmed flywheels for various applications. Standard dimensions of flywheels.	04
Module 04	**Design of main component of gear pump –** 1. Motor selection 2. Gear design 3. Shaft design and bearing selection 4. Casing and bolt design 5. Suction and delivery pipe.	08
Module 05	**Design of gear boxes for machine tool applications-** Determination of variable speed range- graphical representation of speeds- structure diagram- deviation diagram- ray diagram- selection of optimum ray diagram- difference between number of teeth of successive gears in a change gear box- analysis of twelve speed gear box- compound ray diagram.	08

Module 06	**Design of Material Handling System** Design of belt conveyors-- Power requirement, selection of belt, design of tension take up unit ,idler pulley	08

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral examination will be on maximum portion of the syllabus.

Term Work:

The term work shall consist of

1. Design project.

The design project shall consist of two imperial size sheets - one involving assembly drawing with a part list and overall dimensions and the other involving drawings of individual components, manufacturing tolerances, surface finish symbols and geometric tolerances.

A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file.

Projects shall be in the form of design of mechanical systems such as pressure vessel, Conveyor system, Multi speed gear box, Hoisting system.

2. Assignments based on above topics.

The distribution of marks for term work shall be as follows:

- Laboratory work (Assignments/Design Project): …… (15) Marks.
- Test (at least one): …… (10) Marks.

TOTAL: …… (25) Marks.

NOTE:

Use of standard design data books like PSG Data Book , Design Data by Mahadevan is permitted at the examination and shall be supplied by the college.

Text Books:

1) Shigley J.E. and Mischke C.R., "Mechanical Engineering Design", *McGraw Hill Pub. Co. Ltd.*
2) M.F.Spotts – 'Mechanical design analysis' *Prentice Hall Inc*.
3) Bhandari V.B., "Design of Machine Elements", *Tata McGraw Hill Pub. Co. Ltd.*
4) Black P.H. and O. Eugene Adams, "Machine Design", *McGraw Hill Book Co. Inc.*
5) "Design Data", P.S.G. College of Technology, Coimbatore.
6) I.S. : 2825 Code for unfired pressure vessels.

References

1) Johnson R.C., "Mechanical Design Synthesis with Optmisation Applications", *Von-Nostrand-Reynold Pub.*
2) Dieter G.E., "Engineering Design", *McGraw Hill Inc.*

3) S.K. Basu and D.K. Pal – 'Design of machine tools', *Oxford and IBH Pub. Co.*
4) N.K.Mehta – 'Machine tool design' *Tata McGraw Hill Pub. Co.*
5) S.P. PATIL – 'Mechanical System Design' JAICO students Ed., JAICO *Publishing House, Delhi*
6) Rudenko – 'Material Handling Equipment' *M.I.R. publishers, Moscow*

CLASS: BE (Mechanical)			Semester:-VIII
SUBJECT : **PROCESS EQUIPMENT DESIGN (ELECTIVE-II)**			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	03	100
	Practical	--	--
	Oral Examination		25
	Term Work		25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**Types of Process Equipments and their components** **Static Equipments** : Vertical / Horizontal vessels , Columns , Reactors , Spherical vessels (Horton sphere) , Heat Exchangers , Tanks , Mounded Bullets , Fire Heaters etc. **Rotating Equipments** :Pumps ,Compressors, Agitators ,Rotary Dryers	4
Module 02	**Design Loads :** Design Pressure , Design temperature , Dead loads ,Wind loads, Earthquake loads , Piping loads , Combinations of design loads.	10
Module 03	**Stress Categories and Design Limit Stresses** General design criteria of ASME pressure Vessel code Section VIII Div. 1, ASME pressure vessel code Section VIII Div. 2, IS 2825, Indian Boiler Regulations ,BS 5500 , etc. Design stress limits & minimum thicknesses as per TEMA for Heat Exchangers &API 650 /620 for tanks. Membrane stress analysis of Vessel shell components	5
Module 04	**Material selection & Design of Cylindrical Vessels components as per codes and Standards** Design of shell , Formed closures (Ellipsoidal , Spheroidal , Torispherical , conical ,Flat), Nozzles , standard flanges , girth flanges , Supports (Lug , Leg , Skirt , saddle etc.),expansion joints. Design of cylindrical vessels with formed closures operating under external pressure. Wind and Seismic calculation for tall vertical vessels as per IS 875 & IS 1893 .Empty weight ,hydrostatic weight & operating weight calculations.	18
Module 05	**Brief Introduction -**Tank Design as per API 650/API 620 Heat Exchanger Design as per ASME Section VIII UHX Types & Different parts of Heat Exchangers as per TEMA	5
Module 06	**Inspection , Testing & Heat Treatment requirements for pressure vessels** (As per ASME Section VIII ,Division 1, division 2 , ASME Section V, IS2825 , IBR etc.) Hydrostatic test , Dye Penetration test , Ultrasonic testing, fatigue test, creep test etc. Requirement of Radiography , Post Weld Heat Treatment.	6

Theory Examination:

8. Question paper will comprise of total seven question, each of 20 Marks
9. Question one will be compulsory and based on maximum part of syllabus.
10. Only five question need to be solved.

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:
Oral examination will be on maximum portion of the syllabus.

Term Work:
ASSIGNMENTS

1 Explain types of process equipments (Static & Rotary).
2 Design of Shell , Formed heads for internal & external pressure.
3 Design of flanges.
4 Design of vessel supports.
5 Wind & Seismic calculation for pressure vessel.
8 Empty, Operating & hydrostatic weight calculation for pressure vessel.
9 Explain inspection & testing requirement for pressure vessels.
10 Briefly explain Design of storage tanks.
11 Discuss types of heat exchangers.

PRACTICALS
Preparation of General Arrangement Drawing & Detailed fabrication drawing with bill of materials based on design calculation for pressure vessel.

Text Books:
1. Brownell & Young , Process Equipment Design., Wiley India
2. Henry H. Bednar , P. E., Pressure Vessel Design Handbook.
3. Joshi M. V. , Process Equipment design.
4 .Denis Moss , Pressure vessel Design Manual.
5. E. F. Megyesy, Pressure Vessels Handbook

References:
1. An International Code 2007 ASME Boiler & Pressure Vessel Code, Rules For Construction of Pressure Vessels , Section VIII Division1 & 2.
2. IS 2825 , IS 875 , IS1893, IBR .
3. BS 5500.
4. ASME B16.5 , Pipe ,Flanges & Flange Fittings
5. An International Code 2007 ASME Boiler & Pressure Vessel Code, Rules For Construction of Pressure Vessels , Section II A,B,C&D
6. Standards of Tubular Exchanger Manufactures Association (TEMA)
7. API Standards 650 , 620.