B.TECH (AERONAUTICAL ENGINEERING)

SCHEME OF STUDIES & EXAMINATIONS

AND

SYLLABUS

FOR

SEMESTERS V TO VIII

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

2010

M. D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B. Tech. 3rd YEAR (SEMESTER – V)
AERONAUTICAL ENGINEERING
Effective from 2010-11

SUBJECT CODE	Course	PERIODS/WEEK				MARKS			Duration of Ext. Exam
		L	T	P	TOTAL	INT	EXT	TOTAL	
AE-301	Aerodynamics - II	3	1	0	4	50	100	150	3 Hrs
AE-303	Flight Mechanics	3	1	0	4	50	100	150	3 Hrs
AE-305	Aeroelasticity	3	1	0	4	50	100	150	3 Hrs
AE-307	Wind Tunnel Techniques	3	1	0	4	50	100	150	3 Hrs
AE-309	Aircraft Propulsion	3	1	0	4	50	100	150	3Hrs
AE-311	Communication and Navigation	3	1	0	4	50	100	150	3 Hrs
AE-313	Aircraft Structures Lab	0	0	3	3	25	25	50	2 Hrs
AE-315	Propulsion Lab	0	0	3	3	25	25	50	2 Hrs
AE-317	Communication and Navigation Lab.	0	0	2	2	25	25	50	2 Hrs
AE-319	**Practical Training-I**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-**
	Total	**18**	**6**	**8**	**32**	**375**	**675**	**1050**	

Notes:

1. **Assessment of Practical Training-I, undergone at the end of IV Semester, will be based on seminar, viva-voce, report and certificate of Practical Training obtained by the student from the industry. According to performance letter Grades A, B, C, F are to be awarded. A student who is awarded 'F' grade is required to repeat Practical Training.**

2. **Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.**

M. D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B. Tech. 3rd YEAR (SEMESTER – VI)
AERONAUTICAL ENGINEERING
Effective from 2010-11

SUBJECT CODE	Course	PERIODS/WEEK				MARKS			Duration of Ext. Exam
		L	T	P	TOTAL	INT	EXT	TOTAL	
AE-302	Introduction to Wind Energy	3	1	0	4	50	100	150	3 Hrs
AE-304	Compressible Aerodynamics	3	1	0	4	50	100	150	3 Hrs
AE-306	Aircraft Systems	3	1	0	4	50	100	150	3 Hrs
ME-310E	**Measurements and Instrumentation**	**3**	**1**	**0**	**4**	**50**	**100**	**150**	**3 Hrs**
AE-308	**Boundary Layer Theory**	**3**	**1**	**0**	**4**	**50**	**100**	**150**	**3 Hrs**
ME-306E	**Heat Transfer**	**3**	**1**	**0**	**4**	**50**	**100**	**150**	**3 Hrs**
ME-316E	**Heat Transfer Lab**	**0**	**0**	**3**	**3**	**50**	**50**	**100**	**3 Hrs**
ME-318E	**Measurements and Instrumentation Lab**	**0**	**0**	**2**	**2**	**25**	**25**	**50**	**2 Hrs**
AE-310	**Aircraft Systems Lab**	**0**	**0**	**3**	**3**	**25**	**25**	**50**	**3 Hrs**
GPAE-302E	**General Proficiency**	**0**	**0**	**0**	**0**	**50**	**0**	**50**	**-**
	Total	**18**	**6**	**8**	**32**	**450**	**700**	**1150**	

Notes:

1. **Each student has to undergo Practical Training of 6 weeks during summer vacation and its evaluation shall be carried out in the VII Semester.**

2. **Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.**

M. D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B. Tech. 4th YEAR (SEMESTER – VII)
AERONAUTICAL ENGINEERING
Effective from 2010-11

SUBJECT CODE	Course	PERIODS/WEEK				MARKS			Duration of Ext. Exam
		L	T	P	TOTAL	INT	EXT	TOTAL	
AE-401	Helicopter Dynamics	3	1	0	4	50	100	150	3 Hrs
AE-403	Airplane Design	3	1	0	4	50	100	150	3 Hrs
AE-407	Automatic Flight Control	3	1	0	4	50	100	150	3 Hrs
ME-405E	**Operations Research**	**3**	**1**	**0**	**4**	**50**	**100**	**150**	**3Hrs**
	Open Elective	**3**	**1**	**0**	**4**	**50**	**100**	**150**	**3 Hrs**
AE-409	**Aeromodelling Lab**	**0**	**0**	**3**	**3**	**25**	**25**	**50**	**3 Hrs**
AE-413	**Computational Fluid Dynamics Lab**	**0**	**0**	**3**	**3**	**50**	**50**	**100**	**3 Hrs.**
AE-415	**Project**	**0**	**0**	**4**	**4**	**50**	**0**	**50**	**3 Hrs**
AE-417	**Practical Training-II**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-**
	Total	**15**	**5**	**10**	**30**	**375**	**575**	**950**	

Open Electives

ME-407E	Mechanical Vibrations	IC-455E	Intelligent Instrumentation for Engineers
ME-451E	Finite Element Methods	IT-471E	Management Information System
HUM-453E	Human Resource Management	CSE-451E	Artificial Intelligence & Expert Systems
HUM-457E	Business Communication		

Notes:

1. **Assessment of Practical Training-II, carried out at the end of VI Semester, will be based on seminar, viva-voce, report and certificate of Practical Training obtained by the student from the industry. According to performance letter Grades A, B, C, F are to be awarded. A student who is awarded 'F' grade is required to repeat Practical Training.**

2. **Students will be allowed to use Non-Programmable Scientific Calculator. However, sharing of calculator will not be permitted in the examination.**

M. D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B. Tech. 4th YEAR (SEMESTER – VIII)
AERONAUTICAL ENGINEERING
Effective from 2010-11

SUBJECT CODE	Course	PERIODS/WEEK				MARKS			Duration of Ext. Exam
		L	T	P	TOTAL	INT	EXT	TOTAL	
AE-404	Rocket & Missiles	3	1	0	4	50	100	150	3 Hrs
AE-406	Computational Aerodynamics	3	1	0	4	50	100	150	3 Hrs
AE-416	**Flight Dynamics**	**3**	**1**	**0**	**4**	**50**	**100**	**150**	**3 Hrs**
	Elective-I	3	1	0	4	50	100	150	3 Hrs
AE-408	Aeromodelling Lab	0	0	3	3	50	100	150	3 Hrs
AE-410	Independent Study Seminar	0	0	4	4	50	-	50	2 Hrs
AE-415	Project	0	0	8	8	50	100	150	3 Hrs
GFAE-402	General Fitness for Profession	0	0	0	0	50	100	150	3 Hrs
	Total	**12**	**4**	**15**	**31**	**400**	**700**	**1100**	

Elective – I

ME-402E Computer Aided Design

ME-444E Ergonomics and work place design

ME-446E Modern Manufacturing Processes

Notes:-

1. **Project load will be treated as 2 hrs. per week for the project coordinator and 1hr. for each participating teacher. Project involving design, fabrication, testing, computer simulation, case studies etc. that has been commenced by students in VII Semester will be completed in VIII Semester.**
2. **The evaluation of the student for his/her General Fitness for the Profession shall be carried out by a team consisting of Principal /Director, HOD of concerned department and external examiner appointed by university.**
3. **Students will be allowed to use the non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.**

SEMESTER V

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-301: AERODYNAMICS II

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Conformal Transformation
Complex potential function, Blasius theorem, principles of conformal transformation, Kutta - Juokowaski transformation of a circle into flat plate, airfoils & ellipses.

Unit-II: Incompressible Flow over Airfoils
Glauert's thin airfoil theory, symmetrical airfoil, cambered airfoil, flapped airfoil, determination of mean camber line shapes for uniform & linear distribution of circulation. Description of flow about multi-element airfoils.

Unit-III: Incompressible Flow over Finite Wings
Downwash & induced drag, Biot-Savart's law and Helmholtz's theorem, Prandtl's classical lifting line theory, fundamental equations. Elliptic and general lift distribution over finite unswept wings, effect of aspect ratio, Drag polar ,Correlation of Cl distribution over other aspect ratios, Lifting Surface theory, Formation Flying, Ground effect.

Unit-IV: Computational Aerodynamics of Airfoils and Wings
Computation of flow field due to distribution of source doublet and line and horse shoe vortices, vortex lattic method,wing as a planar surface covered with HSVs.

Unit-V: Delta Wing Aerodynamics
Polhamus theory, leading edge suction analogy, calculations of lift coefficient, flow field, aspect ratio effect, leading edge extension, HAA aerodynamics

Unit-VI: Compressible Subsonic Flows over Airfoils
The derivation of velocity potential equation. Linearization , Prandtl-Glauert compressibility correction. Karman –Tsien correction, Critical Mach number, Whitcomb's area rule, Super critical airfoil.

Books:

1. Fundamentals of Aerodynamics : John D.Anderson,2nd Ed. McGrawHill,1991
2. Aerodynamics for Engineers : Bertin and Smith,Prentice Hall,1989

References:

1 Aerodynamics for engineering students ; Houghten EL & Brock AE

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-303: FLIGHT MECHANICS

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Stick Fixed Static Longitudinal Stability
Introduction to stability of airplane, stick fixed longitudinal stability, effect of power, Neutral point, Centre of gravity limits. In flight measurement of stick fixed neutral point.

Unit-II: Control Surfaces And Aerodynamic Balancing
Control surface hinge moments, floating and restoring tendencies, different types of tabs used on airplanes. Frise Aileron, Spoler Controls.

Unit-III: Stick Free Static Longitudinal Stability
Effect of free elevator on airplane stability, Elevator Control force, stick force gradients, Neutral point, Controls free center of gravity limit. In flight measurement of stick free neutral point.

Unit-IV: Maneuvering Flight
Effect of acceleration on airplane balancing, Elevator angle per g, and stick force per g, Maneuver margins.

Unit-V: Directional Stability and Controls
Assymetric flight, Weather cock stability, contribution of different parts of Airplane, Rudder Fixed and Rudder free static directional stability, rudder lock.

Unit-VI: Lateral Stability and Control
Dihedral Effect. Contribution of different. Parts of airplane controls in Roll, Aileron control power, cross coupling of lateral and directional effects.

Unit-VII: Dynamic Stability
Introduction to dynamics, spring-mass system. Equations of motion without derivation, stability derivatives.

(a) Longitudinal Dynamic Stability: Approximate analysis of short period and phugoid modes, stick-fixed and stick-free.
(b) Lateral and Directional Dynamic Stability: approximate analysis of roll subsidence spiral mode and dutch roll.

Books:

1. Airplane Performance Stability and Control - Perkins and Hage, John Wiley, 1949
2. Dynamics of flight : Bernard Etkin, John Wiley 1989

References:

1 Aircraft stability and control for pilots and engineers : Dickinson

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-305: AEROELASTICITY

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Introduction
Definition and historical background, Static and dynamic aeroelastic phenomenon, integretion of aerodynamic, elastic and inertia forces, influence of aeroelstic phenomenon on air craft design, comparison of critical speeds.

Unit-II: Divergence of Lifting Surface
The phenomenon of divergence, divergence of 2-D wing section, divergence of an idealized cantilever wing, solution based on semi-rigid assumptions, solution to generalized co-ordinates Method of successive approximation, use of Numerical Methods.

Unit-III: Steady State Aero-Elasticity Problems in General
Loss and reversal of aileron Control: 2D case, aileron reversal general case. Lift distribution on a rigid and elastic wing. Effect on Static Longitudinal stability of airplane.

Unit-IV: Introduction to Flutter And Buffeting
The phenomenon of flutter, flutter of a cantilever wing. Approximate determination of critical speed by Galerkin's Method, buffeting and stall flutter--an introduction

Unit-V: Non Aeronautical Problems
Some typical example in civil engineering, Flow around an oscillating circular cylinder applications to H-shaped sections, Prevention of aero-elastic instabilities.

Books:
1. An introduction to the Theory Of Aeroelasticity : Y.C. Fung, Dover Publications 1st Ed.1967

References:
1. Aeroelasticity : R.L Bisplinghoff Holt Ashley R.L Halfman, Addison–Wesley Publishing Co. Reading Mass, 1st Ed, 1965

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-307: WIND TUNNEL TECHNIQUES

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Wind Tunnel as a Tool
Test section, diffuser, fan section, fan design, return passage, cooling,The breather- vibration, test section flow quality, diffuser design , wind tunnel construction , energy ratio, final form.

Unit-II: Instrumentation and Calibration of Test Section
Measurement of pressure, velocity, turbulence , flow angularity, hot wire anemometry, laser velocimeter, data acquisition, flow visualization techniques, wind tunnel calibration.

Unit-III: Model Forces, Moment and Pressure Measurement
Wind tunnel balances- Internal & External balances, design of wind tunnel balances, Wake survey method.

Unit-IV: Wind Tunnel Correction
Method of Images , boundary corrections, buoyancy corrections, wake blockage, solid blockage- (2D & 3D corrections).

Unit-V: Non Aeronautical Uses of the Wind Tunnel
Applications in wind engineering, Surface vehicle testing, testing of buildings for wind forces, pollution, other applications at low Reynolds numbers.

Books:
1. Low speed wind tunnel testing, : W.E.Rae and A.Pope, John Wiley 1985.

References:
1. Measurement of Airflow Pankhrust and Ower , Pergamon Press

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-309: AIRCRAFT PROPULSION

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Basics of simple flows
Nozzle flow, nozzle design, nozzle operating characteristics for isentropic flow, nozzle flow and shock waves. Nozzle characteristics for some operational engines. Rayleigh flow and Fanno flow. Effect of frictional duct length in subsonic flow and supersonic flow, numerical problems in 1D flow.

Unit-II: Inlets, Nozzles and Combustion Chambers
Subsonic inlets: pressure recovery, inlet sizing drag flow distortion. Supersonic inlets: Total and sonic state points, A/A* normal shock based internal compression inlets,. Combustion systems, burners, ignition, flame stability. After burners: System design, flame stability, pressure losses etc.

Unit-III: Aircraft Gas Turbine Engines
Air-standard Brayton cycle, actual gas turbine engine cycle, compressor and turbine efficiencies, compressor work and turbine work, centrifugal and axial type of compressor, their comparative action, relative merits in operations, combustion chambers: various arrangements, simplex and duplex burners. line design. Flow path dimensions, no. of blades per stage. Radial variation, design process, performance.

Unit-IV: Axial Flow Compressor
Euler's Turbo machinery equations. Axial flow compressor analysis, cascade action, flow field. Euler's equation, velocity diagrams, flow annulus area stage parameters. Degree of reaction, cascade airfoil nomenclature and loss coefficient, diffusion factor, stage loading and flow coefficient, stage pressure ratio, Blade Mach No., repeating stage, repeating row, mean

Unit-V: Axial Flow Turbine
Introduction to turbine analysis, mean radius stage calculations, stage parameters, stage loading and flow coefficients degree of reaction, stage temperature ratio and pressure ratio, blade spacing, radial variation, velocity ratio. Axial flow turbine, stage flow path, Dimensional stage analysis, Multistage design; steps of design: single stage and two stages. Turbine performance, Blade cooling.

Unit-VI: Propellers
Ideal momentum theory and blade element theory and their relative merits, numerical problems on the performance of propellers using propeller charts, selection of propellers, fixed, variable and constant speed pro pellers, prop-fan, material for propellers, shrouded propellers helicopter ,rotor in hovering performance.

Books:
1. Gas Turbine Theory – Saravanamuttoo, H I H, Cohen and Rogers
2. Aircraft Gas Turbine Engine Technology – Treager, Irwin E

References:
1. Jet Aircraft power systems: Casamassa JV & Bent

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-311: Communication and Navigation

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit – I: Introduction to Radar
Principle of Radar; Block diagram of pulse Radar system, Radar frequencies, Applications of Radar, Classification of Radar, Radar range equation in simple form, Factors affecting the radar performance, Minimum detectable signal.

Unit – II: Electronic Aids to Navigation
Principle, operation and characteristics of: Radio Direction finder, ADF system, VOR and DVOR, LORAN, OMEGA Navigation system, DME & TACAN, Instrument Landing System (ILS) & Microwave Landing system (MLS), Doppler Navigational System, Radio Altimeter System, Satellite Navigational System – NAVSAT, GPS, DGPS.

Unit – III: Guidance
Basic Guidance system, Types of Guidance systems, Gyros, Gyroscopes as motion sensors, various types of gyros. Rate gyros monitors. Accelerometers –Introduction; theory accelerometers or sensor for INS and FCS. Inertial Navigation system (INS), Strap down navigation system.

Unit – IV: Display Systems
Operation and working of - Cathode Ray Tubes (CRT), LCD, Active Matrix LCD, Head Down Display (HDD), Head up display (HUD), Helmet Mounted Display (HMD), Integrated stand by Instrument system (ISIS), Plan Positions Indicator (PPI), Comparison of earlier flight deck (Electromechanical type instruments) to modern flight deck (glass flight deck)

Unit – V: Sensors
Air data sensing, Role of Air data computer, Magnetic sensing – Magnetic Heading Reference System, Radar Sensing – Radar Altimeter, Doppler Radar, Weather radar.

Unit – VI: Communication
HF, V/UHF Satellite communication, Air traffic control transponder, traffic collision and avoidance system, Identification of friend or foe

Books:
1 Malvino, A.P. and Leach, D.P.," Digital Principles and Application ", Tata McGraw Hill, 1990

References:
1. M I Skolnik, "Introduction to Radar", MGH
2. Middleton, D.H., Ed., " Avionics systems ", Longman Scientific and Technical, Longman Group UK Ltd., England,1989
3. Spitzer, C.R., " Digital Avionics systems ", Prentice-Hall, Englewood Cliffs, N.J., U.S.A., 1987
4. Fundamental of Radar, Sonar and Navigation Engg.; K.K. Sharma; S.K. Kataria & sons
5. Malvino, A.P. and Leach, D.P.," Digital Principles and Application ", Tata McGraw Hill, 1990
6. Gaonkar, R.s., "Microprocessors Architecture - Programming and Applications ", Wiley and Sons Ltd, New Delhi, 1990

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-313: AIRCRAFT STRUCTURES LAB

L	T	P
0	0	3

Sessional : 25 Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam : 3 Hrs

List of experiments

1. Study the construction of fuselage and identify the primary load carrying members.
2. Study the construction of wings, ailerons, flaps, slits , slats and spoilers.
3. Study the construction of empennage, stabilizers, rudders adjusting tabs etc with detail of honeycomb structure.
4. Study the construction of landing gears and wheel turning mechanism.
5. Study of aileron control linkages including artificial feel mechanism, booster and manual controls and their adjustments.
6. Study the measurement techniques with strain gauges.
7. Study checks on airframe for life extension.
8. Dye penetrant testing for surface crack detection.
9. Measurement of deflection of truss using DTI.
10. Measurement of deflection of simply supported beam.
11. Determination of compressive strength of thin plates.

Notes:

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

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-315: PROPULSION LAB

L	T	P
0	0	3

Sessional : 25 Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam : 3 Hrs

List of Experiments :

1. Study the constructional details of axial flow compressor
2. Study the constructional details of centrifugal compressor
3. Study of accessory gear box and its construction
4. Study the constructional details of main fuel pump
5. Study the constructional details of combustion chamber
6. Study the constructional details of after burning system
7. Study the constructional details of piston engines
8. Study the functioning of complete jet engine
9. Study the constructional details of propellers

Notes:

1. **At least eight experiments are to be performed in the semester**
2. **At least six experiments are to be performed from above list. Remaining two experiments may either be performed from above list or designed and set by concerned institute as per the scope of the syllabus**
3. **Students will be taken to HAL/Air Force Station to witness aero engine run on test bed.**

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-317: COMMUNICATION AND NAVIGATION LAB

L	T	P
0	0	3

Sessional : 25 Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hours

List of experiments

1. Carry out the functional check of radio altimeter
2. Carry out functional check of gyros for their rigidity & precision & study of various type of gyros and their errors.
3. Comparison of electromechnical instruments and digital instruments.
4. Working of DME and measurement of distance.
5. Setting up of V/UHF communication.
6. Carry out functional check of control by Fly by wire.
7. Obtain co-ordinates with GPS.

Notes:

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

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-319 PRACTICAL TRAINING-I

At the end of Semester IV each student would undergo six weeks Practical Training in an Industry/ Professional Organization/ Research Laboratory with the prior approval of the Director-Principal / Principal of the concerned college and submit a written / typed report along with a certificate from the organization. The report will be a evaluated during Semester V by a Board of Examiners to be appointed by the Director-Principal/ Principal of the concerned college who will award one of the following grades:

Excellent	:	A
Good	:	B
Satisfactory	:	C
Not satisfactory	:	F

A student who has been awarded 'F' grade will be required to repeat the practical training.

SEMESTER VI

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-302: INTRODUCTION TO WIND ENERGY

L	T	P
3	1	0

Sessional: 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Introduction
History of wind power technology, wind resources, economic viability, experience in Europe and America, The Indian experience, factors in favor of wind energy, environmental effects.

Unit-II: Classification of Wind Machines
Types of wind energy collectors: horizontal axis rotors; Head on, Fixed pitch and variable pitch blade rotors, cross wind. Vertical axis rotors; Savonius type and its variants, Darrieus type .lift based devices and drag devices.

Unit-III: Some Case Studies
Description of various types of wind energy conversion systems (WECS) in use through their design features from 1kW range onwards. Considerations of complexities getting in to the design and operation with increase in size and power output.

Unit-IV: Application
Stand alone system; water pumping, direct heating and electric generation applications. Wind energy farms; Grid connected mode ,hybrid mode.

Unit-V: Siting
Wind histories, wind characteristics, power in wind stream, recording wind streams, wind rose, choice of site.

Unit-VI: Performance of Wind Machines
Power extraction from the wind stream, Ideal power coefficient, Typical performance curves for various types, maximum power coefficients, speed-torque curves, power density of a wind stream, ducted system, vortex generator.

Unit-VII: System Design
Objectives, power requirements, wind availability, type and size of WECS required, cost of energy delivered, WECS viability, system characteristics, system requirements, system evaluation, design optimization, wind system design synthesis.

Books:
Wind Machines : Frank R Eldridge, Van Nostrand Reinhold 1980.

References:
Wind power principles, Calvert, NG, Charles Griffin & Co.

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-304: COMPRESSIBLE AERODYNAMICS

L T P
3 1 0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Shock Waves
Introductory remarks, point source in a compressible flow, Mach waves and shock waves.

1. Normal Shock waves: equation of motion for a normal shock, normal shock relations for a perfect gas, stagnation conditions, RH relations, propagating shock waves, weak shock, reflected shock wave, centered expansion waves, shock tube. Numerical examples
2. Oblique Sock waves: Introduction, oblique shock relations, M-θ-β relations, shock polar, supersonic flow over wedge, weak oblique shock, supersonic compression, detached shock. Numerical examples.

Unit-II: Expansion waves
Supersonic expansion by turning, Prandtl-Meyer flow, Numerical problems. Simple and non simple regions, reflection and intersection of shocks and expansion waves, Mach reflections, Method of characteristics, numerical examples

Unit-III: Lift and drag in supersonic flows
Shock –Expansion theory, flow field in supersonic, flow field in supersonic flows, numerical problems, hin airfoil theory, analytical determination of lift and drag coefficients on flat plate, bi-convex, and diamond shaped sections in supersonic flows, numerical problems, supersonic leading and trailing edges.

Unit-IV: Potential equation for compressible flows
Introduction, Crocco's theorem, derivation of basic potential equation foe compressible flows, linearization of governing equation, boundary conditions, small perturbation theory, application to wavy wall, bodies of revolution.

Unit-V: Airfoils in compressible flow
Introduction, linearized compressible flow, airfoils in subsonic flow, Prandtl-Glauert transformation, critical Mach number, supercritical flows, airfoils in transonic flow, governing equations, shock wave boundary layer inter action,stability and control problems.

Unit-VI: Measurements in Compressible flows
Rayleigh's supersonic Pitot formula, Equipment used in supersonic flows, supersonic wind tunnels, heat transfer tunnels, shock tunnels, Aero-ballistic ranges, terminal ballistic range, rocket sled facility, special instrumentation for these types of tunnels.

Books:
1. Aerodynamics and thermodynamics of compressible fluid flow: Shapiro A.H., Vols I & II
2. Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion, S.M. Yahya, New Age International Publishers

References:
1. Elements of Gas Dynamics : Lieppmann and Roshko ,John Wiley 1957
2. Modern compressible Flow with historical perspective: John D. Anderson
3. Experimental Methods in Hypersonic flows: J. Lucasiewisz.

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-306: AIRCRAFT SYSTEMS

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Air conditioning and Cabin pressurization
Air supply sources including engine bleed, APU and ground Cart. Air-conditioning System component layout, functioning of individual components & routine checks on the system, Distribution system, Flow temperature and humidity control.

Unit-II: Fire protection system
Fire and Smoke detection and warning system, Fire extinguishers system, Portable fire extinguisher type of Fire detectors, Standard operating procedures for fire on ground.

Unit-III: Fuel System
System layout , fuel tanks , supply system, dumping, venting and draining, Indications and warning, functioning of various components, checks during routine servicing. Common problems in the system components.

Unit-IV: Hydraulic power system
Layout, hydraulic reservoirs and accumulators, pressure generation , pressure control, indication and warning system functioning of hydraulic pump. Checks on hydraulic oil, layout of hydraulic lab.

Unit-V: Icing Protection system
Ice formation classification and detection, anti icing system, deicing system, working of system in general. Effect of ice formation on functioning on various system.

Unit-VI: Oxygen system
System layout, supply regulation, sources, storage charging and distribution. Indications and warning Engine oxygen system, procedures for carrying out oxygen leak check, precaution while working on oxygen system.

Books:
1. Airframe and Power plant mechanics – Airframe hand book
2. Civil Aircraft Injection Procedure

References:
1. Aircraft repair manual – Lary Rethmaier
2. Light Aircraft Inspection – J E Heywrod

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME – 310 E MEASUREMENTS AND INSTRUMENTATION

L	T	P
3	1	-

Sessional : 50 Marks
Theory : 100 Marks
Total marks : 150 Marks
Duration of Exam: 3 Hrs.

Unit-I: Instruments and Their Representation
Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration.

Unit-II: Static and Dynamic characteristics of Instruments
Introduction, Accuracy, Precision, Resolution, Threshold, Sensitivity, Linearity, Hysteresis, Dead Band, Backlash, Drift, Formulation of Differential Equations for Dynamic Performance- Zero Order, First Order and Second order systems, Response of First and Second Order Systems to Step, Ramp, Impulse and Harmonic Functions.

Unit-III: Transducer Elements
Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamic, Eddy Current, Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, Piezo-Electric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Single Double and Four Active Arm Bridge Arrangements, Temperature Compensation, Balancing and Calibration, Ionization Transducers, Mechano Electronic Transducers, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Voltaic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.

Unit-IV: Intermediate, Indicating and Recording Elements
Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements, Filters, Classification of Filters, A-D and D-A Converters, Digital Voltmeters (DVMs), Cathode Ray Oscilloscopes (CROs), Galvanometric Recorders, Magnetic Tape recorders, Data Acquisition Systems, Data Display and Storage.

Unit-V: Motion, Force and Torque Measurement
Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter.

Unit-VI: Pressure and Flow Measurement
Pressure & Flow Measurement, Introduction : Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing, Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Unit-VII: Temperature Measurement
Introduction, Measurement of Temperature, Non Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods – Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

Unit-VIII: Basic Statistical Concepts

Types of Measured Quantities (Discrete and Continuous), Central Tendency of Data, Mode, Median, Arithmetic Mean, Best Estimate of true Value of Data, Measures of Dispersion, Range, Mean Deviation, Variance, Standard Deviation, Normal Distribution, Central Limit Theorem, Significance Test, Method of Least Squares, Graphical Representation and Curve Fitting of Data.

Books:

1. Measurement systems Application and Design. Ernest O. Doebelin, Tata McGraw Hill Edition (4th Edition) 2002.
2. Measurement and Instrumentation in Engineering, Francis S. Tse and Ivan E. Morse, Marcel Dekker.

References:

1. Principles of Measurement and Instrumentation – Alan S. Morris Prentice Hall of India.
2. Mechanical Measurements : T.G. Beckwith, W.L. Buck and R.D. Marangoni Addison Wesley.
3. Instrumentation, Measurement and Analysis – B.C. Nakra and K.K. Chaudhary, TMH.

Note : In the semester examination, the examiner will set eight questions in all, at least one question from each unit & students will be required to attempt only 5 questions.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-308: BOUNDRY LAYER THEORY

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Basics
Basic laws of fluid flow- Continuity, momentum and energy equations as applied to system and control volume –Concept of flow fields- Viscous fluid flow with historical out lines of viscous flow, Boundary conditions for viscous flow problems, Development of boundary layer- Prandtl's hypothesis, Estimation of boundary layer thickness- Displacement thickness, momentum and energy thickness for two-dimensional flows. Viscosity and thermal conductivity, thermodynamic properties.

Unit-II: Derivation of the Navier-Stokes Equations
General stress system in a deformable body, the rate at which the fluid element is strained in a flow, Relation between stress and rate of deformation, Stoke's hypothesis, bulk viscosity and thermodynamic properties, The Navier – Stokes Equation (N-S) –General properties of Navier – Stokes Equation.

Unit-III: Solutions of the Navier-Stokes Equations
Two dimensional flow through a straight channel. Hagen- Poiseulle flow, suddenly accelerated plane wall, Stagnation in plane flow (Hiemenz problem), Flow near a rotating disk, Very slow motion, Parallel flow past a sphere.

Unit-IV: Laminar Boundary Layer
Analysis of flow past a flat plate and a cylinder, Integral relation of Karman, Integral analysis of energy equation, Laminar boundary layer equations, Flow separation. Similarity solutions for steady two dimensional flows; Blasius solution for flat- plate flow, Boundary layer temperature profiles for constant wall temperature, Falkner-Skan Wedge flows, Free shear flows- plane laminar jet, plane laminar wake. Integral equation of Boundary layer, Karman-Pohlhausen method. Digital computer solutions. Thermal boundary layer calculations- One parameter (Uo) and two parameters (Uo and ΔT) integral methods. Stability of laminar flows.

Unit-V: Turbulent Boundary Layer
Two dimensional turbulent boundary layer equations, Integral relations, Eddy-Viscosity theories, Velocity profiles; The law of the wall, The law of the wake. Turbulent flow in pipes and channels.- Turbulent boundary layer on a flat pate, Boundary layers with pressure gradient.

Unit –VI: Compressible Boundary Layer Flows
Introduction to the compressible boundary layer on a flat plate, shock wave boundary layer interaction.

Books:
1. Viscous Fluid Flow 3rd Ed. Frank M White McGraw Hill 2006
2. Boundary Layer theory 6th Ed. H. Schlichting McGraw Hill 1968

References:
1 Aerodynamics for Engineers 4th Ed. John Bertin Pearson 2004

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME-306E HEAT TRANSFER

L	T	P		
3	1	-	**Sessional**	**: 50 Marks**
			Theory	**: 100 Marks**
			Total	**: 150 Marks**
			Duration of Exam	**:3 Hrs.**

Unit-I: Basics and Laws
Definition of Heat Transfer, Reversible and irreversible processes, Modes of heat flow, Combined heat transfer system and law of energy conservation.

Unit-II: Steady State Heat Conduction
Introduction, I-D heat conduction through a plane wall, long hollow cylinder, hollow sphere, Conduction equation in Cartesian, polar and spherical co-ordinate systems, Numericals.

Unit-III: Steady State Conduction with Heat Generation
Introduction, 1-D heat conduction with heat sources, Extended surfaces (fins), Fin effectiveness 2-D heat conduction, Numericals.

Unit-IV: Transient Heat Conduction
Systems with negligible internal resistance, Transient heat conduction in plane walls, cylinders, spheres with convective boundary conditions, Chart solution, Relaxation Method, Numericals.

Unit-V: Convection
Forced convection-Thermal and hydro-dynamic boundary layers, Equation of continuity, Momentum and energy equations, Some results for flow over a flat plate and flow through tube, Fluid friction and heat transfer (Colburn analogy), Free convection from a vertical flat plate, Empirical relations for free convection from vertical and horizontal o\planes & cylinders, Numericals.

Unit-VI: Thermal Radiation
The Stephen-Boltzmann law, the black body radiation, Shape factors and their relationships, Heat exchange between non black bodies, Electrical network for radiative exchange in an enclosure of two or three gray bodies, Radiation shields, Numericals.

Unit-VII: Heat Exchangers
Classification, Performance variables, Analysis of a parallel/counter flow heat exchanger, Heat exchanger effectiveness, Numericals.

Unit-VIII: Heat Transfer with Change of Phase
Laminar film condensation on a vertical plate, Drop-wise condensation, Boiling regimes, Free convective, Nucleate and film boiling, Numericals.

Books:

1. Heat Transfer – J.P. Holman, John Wiley & Sons, New York.
2. Fundamentals of Heat & Mass Transfer–Incropera, F.P. & Dewill, D.P –John Willey New York.

References:

1. Conduction of Heat in Solids – Carslow, H.S. and J.C. Jaeger – Oxford Univ. Press.
2. Compact Heat Exchangers – W.M. Keys & A.L. Landon, Mc. Graw Hill.
3. Thermal Radiation Heat Transfer – Siegel, R. and J.R. Howell, Mc. Graw Hill.

Notes: **1. In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions.**

2. The paper setter will be required to mention in the note of question paper that the use of Steam tables, Charts, Graphical plots is permitted.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME- 316 E HEAT TRANSFER LAB.

L T P	
- - 3	

Sessional : 50 Marks
Practical : 50 Marks
Total : 100 Marks
Duration of Exam : 3Hrs.

List of Experiments

1. To determine the thermal conductivity of a metallic rod.
2. To determine the thermal conductivity of an insulating power.
3. To determine the thermal conductivity of a solid by the guarded hot plate method.
4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
5. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
6. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
7. To determine average heat transfer coefficient for a externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
8. To measure the emmisivity of the gray body (plate) at different temperature and plot the variation of emmisivity with surface temperature.
9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
10. To verify the Stefen-Boltzmann constant for thermal radiation.
11. To demonstrate the super thermal conducting heat pipe and compare its working with that of the best conductor i.e. copper pipe. Also plot temperature variation along the length with time or three pipes.
12. To study the two phases heat transfer unit.
13. To determine the water side overall heat transfer coefficient on a cross-flow heat exchanger.
14. Design of Heat exchanger using CAD and verification using thermal analysis package e.g. I-Deas etc.

Notes:

1. **At least ten experiments are to be performed in the semester.**

2. **At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.**

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME- 318 E MEASUREMENTS & INSTRUMENTATION LAB.

L	T	P
-	-	2

Sessional : 25 Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hrs.

List of Experiments

1. To Study various Temperature Measuring Instruments and to Estimate their Response times.
   (a) Mercury – in glass thermometer
   (b) Thermocouple
   (c) Electrical resistance thermometer
   (d) Bio-metallic strip
2. To study the working of Bourdon Pressure Gauge and to check the calibration of the gauge in a dead-weight pressure gauge calibration set up.
3. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
4. To study the characteristics of a pneumatic displacement gauge.
5. To measure load (tensile/compressive) using load cell on a tutor.
6. To measure torque of a rotating shaft using torsion meter/strain gauge torque transducer.
7. To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric).
8. To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.
9. To measure static/dynamic pressure of fluid in pipe/tube using pressure transducer/pressure cell.
10. To test experimental data for Normal Distribution using Chi Square test.
11. To learn the methodology of pictorial representation of experimental data and subsequent calculations for obtaining various measures of true value and the precision of measurement using Data acquisition system/ calculator.
12. Vibration measurement by Dual Trace Digital storage Oscilloscope.
13. To find out transmission losses by a given transmission line by applying capacitive /inductive load.
14. Process Simulator.

Notes:

1. **At least ten experiments are to be performed in the Semester.**

2. **At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the Syllabus.**

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-310 AIRCRAFT SYSTEMS LAB

L	T	P
0	0	3

Sessional : 25 Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam : 3 Hrs

List of experiments

1. Study the air-conditioning system including cooling turbine, distribution and temperature control system.
2. Study of refuelling procedure and precautions during refuelling.
3. Study of the jacking up operation of the aircraft.
4. Study of hydraulic system internal leak check procedure and precautions.
5. Study of oxygen system layout and storage.
6. Study of the defuelling procedure and the fuel sequencing and its indications.
7. Study of various types of fire in aircraft and use of fire extinguisher.
8. Study of ground running procedure and precautions during ground run.

Notes:

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

SEMESTER VII

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-401: HELICOPTER DYNAMICS

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Elementary Blade Motion
Historical development of helicopter and overview, Basic concepts, Introduction to hovering and forward flight theory, Rotor blade motion – flapping, feathering and lagging motion, Composite structures.

Unit-II: Aerodynamics of the Rotor in Motion
The actuator-disc theory, Working states of rotor, Optimum rotor, Efficiency of rotor, Ground effect on lifting rotor, The effect of finite number of blades, Induced velocity and induced power in forward flight – Mangler and Squire method, flight and wind tunnel test, The vortex wake, Aerofoil characteristics in forward flight.

Unit-III: Helicopter Trim and Performance in Motion
Blade forces and motion in forward flight, Force, torque and flapping coefficient, Helicopter trim analysis, Performance in forward flight.

Unit-IV: Dynamic Stability and Control
Longitudinal and lateral stability, Equations of motion, Stability characteristics, Auto stabilization, Control response.

Unit-V: Helicopter Vibrations
Exciting forces, Fuselage response, Vibration absorbers, Measurement of vibration in flight.

Books:
1. Helicopter Dynamics : Bramwell, A.R.S.
2. Principles of Helicopter Engineering :Jacob Shapiro

References:
1. Aerodynamics of Helicopter, Gessow, A, and Myers GC

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-403: AIRPLANE DESIGN

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Introduction
Aircraft design, requirements and specifications, airworthiness requirements. Weight: It's importance. Aerodynamic and structural design considerations. Classifications of airplane, Concept of configuration, features of special purpose airplanes. Unmanned aerial vehicles and their features.

Unit-II: Air Loads In Flight
Classical methods of estimating symmetrical maneuvering loads on a wing in flight, basic flight loading conditions, Load factor, V-n diagram, gust loads, estimation of gust loads, structural effects. use of panel methods to estimate air load distribution on a wing.

Unit-III: Airplane Weight Estimation
Estimation of airplane weight based on airplane type / mission and material used. trends in wing loading, iterative approach

Unit-IV: Wing Design Considerations
Factors influencing selection of airfoil and plan form. Span wise air loads variation with span and planform, stalling, take-off and landing considerations. BM and SF. Design principles for the structure of all metal, stressed skin wing (Civil & Military airplane).estimation of wing drag, effect of flaps.

Unit-V: Structural Layout And Integration
Structural layout of straight, tapered swept (fwd and aft) wings. fuselage, empennage, Engine locations, Cockpit and passenger cabin layout, layout of flight and engine controls. wing-fuselage jointing methods, all metal airplane considerations, use of composite materials. Preparation of 3-views .CG location.

Unit-VI: Landing Gears
Requirement of landing gears, different arrangements ,mechanism for retraction into fuselage and wing. absorption of landing loads, calculations of loads.

Unit-VII: Airframe Power plant integration
Estimation of Horizontal and vertical tail volume ratios, number of engines, location for inlets and considerations thereof. Revised CG location.

Books:
1. Airplane Design- A Conceptual Approach : Daniel P. Raymer.
2. Design of Airplane : D.Stinton

References:
1. Fundamentals of Aircraft Design: L.M. Nikolai

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-407: AUTOMATIC FLIGHT CONTROL

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Introduction
Open Loop and Closed Loop (Feed Back) control systems. Types of feedback control systems. Laplace's transform.

Unit-II: Feed Back Control System
Transfer function of linear systems. Impulse response of linear systems, Block diagrams of feed back control systems, Multivariable systems, Block diagram algebra.

Unit-III: Analysis of Feedback Control Systems
Typical test input signals, Time domain performance characteristics of feedback control systems. Effects of derivative and integral control. Steady State response of feedback control system-steady State error, Frequency response.

Unit-IV: System Stability
Routh-Hurwitz Criterion, the Root Locus Method.

Unit-V: Longitudinal Auto-Pilots
Longitudinal Auto Pilots: Brief description through Block diagrams and Root Locus of Displacement Auto Pilot, Pitch Orientational Control System. Acceleration control system. Fly-By-Wire control system, Instrument Landing System.

Unit-VII: Lateral Autopilot
Introduction, Damping of the Dutch Roll, Methods of Obtaining coordination, Yaw orientational control system

Books:
1. Automatic Control of aircraft and Missiles : John H.Blackelock, John Wiley & Sons.

References:
1. Airplane Performance Stability and Control: C.D.Perkins and E.Hage, John Wiley & Sons.

Note: In the semester examination, the examiner will set eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME- 405E OPERATIONS RESEARCH

L	T	P
3	1	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam : 3 Hrs.

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

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

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

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

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

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

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

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

Books:

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

References:

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

Note: Paper setter will set eight questions, at least one from each unit. Students are required to answer five questions.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-409: AEROMODELLING LAB-I

L	T	P
0	0	3

Sessional : 25 Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hours

Each student is assigned the design of an Airplane (or Helicopter or any other flight vehicle), to a given preliminary specifications. The following are the assignments to be carried out:

List of experiments

1. Comparative studies of different types of airplanes and their specifications and performance details.
2. Preliminary weight estimations, selection of main parameters, Power plant selection, Aerofoil selection, Wing, tail and control surfaces.
3. Preparation of lay outs of balance diagram and three view drawings.
4. Drag estimation, Detailed performance, Calculations and Stability Estimates. V-n diagram.

Notes:
1. **Validation of data may be done on wind Tunnel.**
2. **Suitable Software may be used to develop the design data.**

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-413: COMPUTATIONAL FLUID DYNAMICS LAB

L	T	P
-	-	3

Class Work : 50 Marks
Exam : 50 Marks
Total : 100 Marks
Duration of Exam: 3 Hrs.

List of Experiments

1. Modeling a 2-d object with structured mesh using GAMBIT software.
2. Modeling a 2-d object with unstructured mesh using GAMBIT software.
3. Modeling a 3-d object with structured mesh using GAMBIT software.
4. Solving a simple 2-d flow problem using FLUENT software.
5. Solving a simple 2-d axisymmetric flow problem using FLUENT software.

Note:

1. At least six experiments are to be performed. The additional experiments may either be performed from above list or designed and set by concerned institute as per the scope of the syllabus.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-415 PROJECT

L	T	P
-	-	4

Sessional : 50 Marks
Practical : 0 Marks
Total : 50 Marks
Duration of Exam: 3Hrs.

Project involving design/ fabrication/ testing/ computer simulation/ case studies etc., which is commenced in Semester VII, will be completed in Semester VIII and will be evaluated through a panel of examiners consisting of HOD of the concerned department, project coordinator and one external examiner to be appointed by the University.

The student will be required to submit three copies of his/her project report to the office of the concerned department for record (one copy each for the Department Office, participating teacher and college library).

Project coordinator will be assigned the project load of 2 hrs., per week while the participating teachers will be assigned 1 hr. load for the same.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE- 417 PRACTICAL TRAINING-II

At the end of sixth semester each student would undergo six weeks Practical Training in an Industry/ Professional / Organization/ Research Laboratory with the prior approval of the Director-Principal/ Principal of the concerned college and submit a written typed report along with a certificate from the organization. The report will be a evaluated during VII Semester by a Board of Examiners to be appointed by the Director-Principal/ Principal of the concerned college who will award one of the following grades:

Excellent	:	A
Good	:	B
Satisfactory	:	C
Not satisfactory	:	F

A student who has been awarded 'F' grade will be required to repeat the practical training.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME-407E MECHANICAL VIBRATIONS

L	T	P
3	1	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs.

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

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

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

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

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

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

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

Books:

1. Theory of Vibrations with Applications W.T. Thomson, Prentice Hall of India.
2. Mechanical Vibration : G.K. Grover and S.P. Nigam, Nem Chand and Sons

References:

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

Note : In the semester examination, the examiner will set eight questions in all, at least one question from each unit & students will be required to attempt only 5 questions.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME-451E FINITE ELEMENT METHODS

L	T	P
3	1	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs.

Unit-I: Fundamental Concepts
Introduction; Historical Background, Stresses and Equilibrium, Boundary Conditions, Strain-displacement, Relations, Stress- strain Relations, Temperature Effects, Potential Energy and Equilibrium; The Rayleigh-Ritz Method, Galerkin's method. Saint Venant's Principle, Matrix Algebra, Gaussian Elimination.

Unit-II: One-Dimensional Problems
Introduction; Finite Element Modeling, Coordinates and a Shape Functions, The Potential Energy Approach; The Galerkin Approach, Assembly of the Global Stiffness Matrix and Load Vector. Properties of Stiffness Matrix, The Finite Element Equations; Treatment of Boundary Conditions, Quadratic Shape Functions; Temperature effects.

Unit-III: Two-Dimensional Problems using Constant Strain Triangles
Introduction, Finite Element Modeling, Constant Strain Triangle, Problem Modeling and Boundary conditions; Axis Symmetric Solids subjected to Axis Symmetric Loading:- Introduction, Axis Symmetric Formulation, Finite Element Modeling; Triangular Element, Problem Modeling and Boundary conditions.

Unit-IV: Two Dimensional Isoparametric Elements and Numerical Integration
Introduction, The Four-Node quadrilateral, Numerical integration stress calculations, High–Order Element; Nine-Node quadrilateral, Eight-Node Quadrilateral, Six-Node triangle, Comment on Midside Node; Problems.

Unit-V: Beams & Frames
Introduction, Finite Element formulation, Load Vector, Boundary considerations, Shear Force and Bending Moment, Beams on Elastic supports, Plane Frames, Simple Numerical.

Unit VI: Three-Dimensional Problems in Stress Analysis
Introduction, Finite Element Formulation, Stress Calculations, Mesh Preparation, Hexahedral Elements and Higher- order Elements, Problem Modeling.

Unit-VII: Scalar Field Problems
Introduction, Steady-state Heat Transfer,: Introduction One-Dimensional Heat Conduction, Heat transfer in thin Fins, Two-dimensional steady-state Heat conduction, Potential Flow, Seepage, Fluid flow in Ducts.

Unit-VIII: Dynamic Considerations
Introduction, Formulation, Element Mass Matrices, Evaluation of Eigenvalues and Eigenvectors, Interfacing with previous Finite Element Programs and a program for determining critical speed of shafts.

Books:

1. Introduction to Finite Elements in Engineering Analysis by Tirupathi R. Chandrupatla and Ashok R. Belagundu. Prentice Hall
2. The Finite Element Method in Engineering by S.S.Rao, Pergamon Press, Oxford.

References:

1. The Finite Element Method by Zienkiewicz published by Mc Graw Hill.
2. An Introduction to Finite Element Method by J.N. Reddy, published by Mc Graw Hill.

Note: In the Semester examination, the examiner will set eight questions. At least one question from each unit. The students will be required to attempt only 5 questions.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

HUM-457E BUSINESS COMMUNICATION

L	T	P
4	-	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I Business Correspondence
Characteristics and formats of business letter; Quotations, Orders, Tenders, Sales letters, Claim and adjustment letters, Credit and collection letters, Application letters for vacant situations with emphasis on resumes, E-mail and Netiquette – Format, style and tone.

Unit-II Business Reports and Proposals
Importance, Function, Pattern and formats of reports, Typical business reports, Report organization and presentation and formal reports; Proposal formats, Writing problem-solving proposals, Executive summary proposals and Project proposals.

Unit-III Meetings
Writing of memorandum, Notes, Agenda and Minutes of meeting.

Unit-IV Public Relations and Advertising Documents
Press release, Public service announcements, Advertising strategy and its objectives, Designing of classified and Display advertising copies.

Suggested Readings:

1. Business Communication: Process & Product by Hary Ellen Guffey, IV Edition, South-Western Collage Publishing, Cincinnati.
2. Business correspondence and Report Writing by R.C Sharma & Krishna Mohan, Tata Macgraw Hill Publication, New Delhi.
3. Effective Business English and Correspondence by M.S Ramesh and C.C Pattan Shetti, R. Chand & Co. New Delhi.
4. Effective Letters in Business by Robert by C. Shruter, Tata Macgraw Hill, New Delhi.
5. English Business Letters by F.W. Wing & D. Anncree, Orient Longman.
6. Written Communication in English by Sarah Freeman, Orient Longman.
7. International Business English by Leo Jones & Richard Alexander, Cambridge University Press.
8. General and Business English by Sweet Stephen, Sir lssac Pitman & Sons Ltd, London.
9. How to write and Present Technical Information, Charles H. Sides, Cambridge University Press, U.K.
10. Strategies for engineering communication, Susan Stevenson/Steve Whitmore, John wiley and Sons, Inc. Printed in India by Replika Press Pvt. Ltd Delhi.

Scheme of Examination:
There will be six questions in all, covering all the units. All questions will be compulsory and will have enough internal choice.

Unit-I
There will be two questions from this unit. One question will cover the theoretical aspect of Business letter writing and will carry 10 Marks. The other question will be on writing the letter in a proper format on a subject given and will be of 20 Marks. There will be enough choice taking care of the justice to be given to both the aspects of the letter writing.

Unit-ll
There will be two questions from this unit. One question will cover the theoretical aspect of report/proposal writing and will carry 15 Marks. The Other question will be on preparing the report/proposal on a topic/subject given and will be of 20 Marks. There will be enough choice taking care of the justice to be given to both the aspects of the report writing.

Unit-lll
There will be a question on theoretical aspects of the various items of this unit or students can be asked to draft a specimen of any of these from the material given in the exam. The question can be split in to parts.

Unit-IV
There will be one question having two parts. One part will be on theory and will be of 5 Marks and the other will require the drafting an advertisement copy of a product or service of a public announcement and will carry 15 Marks.

SEMESTER VIII

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE- 404: ROCKETS AND MISSILES

L T P	
3 1 0	**Sessional : 50 Marks**
	Theory : 100 Marks
	Total : 150 Marks
	Duration of Exam: 3 Hrs

Unit-I: Solid Propellant Rocket Systems
Ignition system and ignition transient, Propellant grains, process of making and casting propellant grains, insulation, motor casing, nozzle, thermal protection systems (TPS), ablatives, Interior ballistics, grain and nozzle design.

Unit-II: Liquid Propellant Rocket Systems
Design consideration of liquid rocket combustion chamber, injector, propellant feed systems, valves, propellant tank outlet and helium pressurized and turbine feed systems, Propellant slosh, Propellant hammer, Geysering effect in cryogenic rocket engines.

Unit-III: Aerodynamics of Rockets and Missiles
Components of rockets and missiles, Forces acting on a missile while passing through atmosphere, Classification of missiles, Aerodynamic forces and moments, Lateral aerodynamic moment, Lateral damping moment and longitudinal moment of a rocket, Lift and drag forces, Drag estimation, Body upwash and downwash in missiles, Rocket dispersion.

Unit-IV: Rocket Motion in Vacuum
Equations of motion, Rocket motion in free space (Tsiokovsky's equation, Rocket Parameters, Burnout range), Rocket Motion in a homogeneous gravitational field (Vertical flight, Constant Pitch angle, Gravity turns) Multi-staging of rockets, Ideal velocity of multi-stage rocket, Vertical ascent in a homogeneous gravitational field and in vacuum (Burnout velocity- Culmination altitude-Vertical ascent of a two-stage rocket). Separation techniques.

Unit-V: Attitude Control of Rockets and Missiles
Rocket thrust vector control and various methods used, Thrust magnitude control, Thrust Termination.

Unit-VI: Electric Propulsion
Brief description of electric ion thruster, magneto-plasma dynamics and arc-jet thrusters.

Books:
1. Sutton, G.P., et al., "Rocket Propulsion Elements "John Wiley & Sons Inc., New York, 1993.
2. Mathur, M., and Sharma, R.P., "Gas Turbines and Jet and Rocket Propulsion ", Standard Publishers, New Delhi, 1998.

References:
1. Cornelisse, J.W.., "Rocket Propulsion and Space Dynamics ", J.W., Freeman & Co., Ltd., London, 1982.
2. Parket, E.R., "Materials for Missiles and Spacecraft ", McGraw Hill Book Co., Inc., 1982

Note: In the semester examination, the examiner will set Eight questions, atleast one question from each unit. The students will be required to attempt only 5 questions.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-406: COMPUTATIONAL AERODYNAMICS

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Introduction
Numerical experiments in aerodynamics v/s wind tunnel testing, merits and advantages, limitations, reliability and accuracy of the results, comparisons in safety, risks, cost and time factors. Initial break-throughs, usage of packages for plottings and graphics. Current status

Unit-II: The Navier-Stokes Equations
Stress and strain in a viscous fluid, strain versus rotation, isotropy, the rate of strain tensor,the two coefficients of viscosity, the N-S equations

Unit-III: The Boundary Layer
The laminar boundary layer, velocity, displacement and momentum thickness, Karman's momentum integral equation, velocity profile fitting, Thwaits method , for laminar boundary layer, Velocity profile fitting ,Head's method, separation of BL, The development of circulation about a sharp-tailed airfoil, Computation of boundary layer growth along an airfoil.

Unit-IV: FD Solution of BL Equations
Statement of the problem, similar solutions of the laminar incompressible boundary layer, FD method or Falkner–Skan equation, iterative solution of nonlinear equations, FD methods based on second order differential equation, based on a system of first order equations. Transformation of laminar boundary layer equations for arbitrary pressure gradients. Turbulent BL, separated flows.

Unit-V: Compressible Potential Flow Past Airfoils
Shock waves and sound waves, equations of compressible steady potential flow, P-G equation, subsonic flow past thin airfoil, supersonic flow past thin airfoils and transonic flow past thin airfoils; aerodynamics in the transonic range, solution of TSP equation: sub critical flow, conservation v/s non conservation difference schemes. Super critical flow and upwind differencing, the relaxation iteration, the Poisson iteration.

Books:
1. Computational Aerodynamics : Jack Moran, john Wiley, 1984

References:
1. Computational Fluid Flow and Heat Transfer : Anderson, Tannehill and Pletcher McGraw Hill,1984.

Note: In the semester examination, the examiner will set Eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-416: FLIGHT DYNAMICS

L	T	P
3	1	0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs

Unit-I: Introduction
Fundamentals of vector. Particle and Rigid body kinematics: Fixed frame of reference, rotating frame of reference. Choice of Axes: principal axes, stability axes, body axes. Transformation of coordinates.

Unit-II: Aircraft Equations of Motion
General equations of unsteady motion of airplane: Force equations in moving frame, Moment equations in moving frame. Orientation and position of the airplane: Principle Rotation, Euler angles, Euler rates, Transformation matrix. External forces. Angular velocities equations in moving frame. Velocities equations in moving frame. Flight simulation of powered and unpowered flights.

Unit-III: Small-Disturbance Theory
Linearized equations of aircraft motion: Control fixed longitudinal equations, control fixed lateral-directional equations. Stability criteria. Stability analysis of linearized equations of motion. Airplane longitudinal motion: Short period approximation, Phugoid approximation. Airplane lateral motion: Spiral approximation, Roll approximation, Dutch roll approximation. Sample calculation on longitudinal and lateral motion approximations.

Unit-IV: Stability Derivatives
Expressions for $Cx, and\ Cz$. The α Derivatives: $Cx_\alpha, Cz_\alpha, Cm_\alpha$. The u Derivatives: Cx_u, Cz_u, Cm_u. The q Derivatives: Cz_q, Cm_q. The $\dot{\alpha}$ Derivatives: $C_{L\dot{\alpha}}, C_{m\dot{\alpha}}$. The β Derivatives: $C_{y\beta}, C_{l\beta}, C_{n\beta}$. The p Derivatives: C_{yp}, C_{lp}, C_{np}. The r Derivatives: C_{yr}, C_{lr}, C_{nr}.

Unit-V: Space Dynamics
Central force motion, determination of trajectory and orbital period in simple cases. Orbit transfer, in-plane and out-of-plane.

Books:
Etkin, B., "Dynamics of Flight" 3rd Edition, John Wiley & Sons, Inc.

References:
Nelson, R. C., "Flight Stability and Automatic Control", McGraw-Hill
Roy, A. E., "Foundation of Astrodynamics", Macmillan.
Kaplan, M. H., "Spacecraft Dynamics and Control", John Wiley & Sons, INC.

Note: In the semester examination, the examiner will set Eight questions, at least one question from each unit. The students will be required to attempt only 5 questions

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-408: AEROMODELLING LAB-II

L	T	P
0	0	3

Sessional : 25 Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam: 3 Hours

The design data developed in Semester VII is to be validated by fabrication of an aircraft/ Helicopter/ flight vehicles. Suitable Experiments may be done in wind tunnel after fabrication.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-410 INDEPENDENT STUDY SEMINAR

L	T	P
-	-	4

Sessional : 50 Marks
Practical : 0 Marks
Total : 50 Marks
Duration of Exam: 2 Hours

The student will select a topic in emerging areas of Aeronautical Engineering and study independently. He will give a seminar talk on the same before the committee constituted by the head of the Department. The committee should comprise of at least three faculty members from Aerodynamics, Propulsion & Structures specializations.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

AE-415 PROJECT

L	T	P
-	-	8

Sessional : 50 Marks
Practical : 100 Marks
Total : 150 Marks
Duration of Exam: 3Hrs.

Project involving design/ fabrication/ testing / computer simulation/ case studies etc., which is commenced in Semester VII, will be completed in Semester VIII and will be evaluated through a panel of examiners consisting of HOD of the concerned department, project coordinator and one external examiner to be appointed by the University.

The student will be required to submit three copies of his/her project report to the office of the concerned department for record (one copy each for the Department Office, participating teacher and college library).

Project coordinator will be assigned the project load of 2 hrs. per week while the participating teachers will be assigned 1 hr. load for the same.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

GFAE-402 GENERAL FITNESS FOR PROFESSION

L	T	P
-	-	-

Sessional : 50 Marks
Practical : 100 Marks
Total Marks : 150 Marks
Duration of Exam: 3 Hrs.

At the end of each year students will be evaluated on the basis of their performance in various fields. The evaluation will be made by the panel of experts/examiners/teachers to be appointed by the Principal/Director of the College. A specimen proforma indicating the weight age to each component/ activity is given below:-

Name : _____ College Roll No. _____
Univ.Roll No._____ _____
Branch _____ Year of Admission _____._____

I. Academic Performance (15 Marks):

(a) Performance in University Examination:

Sem.	Result %age of Marks obtained	Number of Attempts in which the Semester Exam has been cleared
I		
II		
III		
IV		
V		
VI		
VII		

II. Extra Curricular Activities (10 Marks) :

Item	Level of Participation	Remarks (Position Obtained)
Indoor Games	_____	
(Specify the Games	_____	
Outdoor Games (Specify the Games)	_____	
Essay Competition	_____	
Scientific Technical Exhibitions	_____	
Debate	_____	

Drama _____
_____
_____

Dance _____
_____
_____

Music _____
_____
_____

Fine Arts _____
_____
_____

Painting _____
_____
_____

Hobby Club _____
_____
_____

N.S.S. _____
_____
_____

Hostel Management _____
Activities _____
_____

Any other activity _____
(Please Specify) _____
_____

III. Educational tours/visits/Membership of Professional Societies (5 Marks)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

IV. Contribution in NSS Social Welfare Floor Relief/draught relief/Adult Literacy mission/Literacy Mission/Blood Donation/Any other Social Service (5 Marks)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

V. Briefly evaluate your academic & other performance & achievements in the Institution (5 Marks)

_____
_____
_____
_____

VI. Performance in Viva voce before the committee (10 Marks)

_____
_____
_____
_____
_____

*Marks obtained 1.( )+II( )+III( )+IV( )+V( )+VI( ) =

**Total Marks :

Member Member Member Member Member

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME- 402E COMPUTER AIDED DESIGN

L	T	P
3	1	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs.

Unit-I: Introduction
Introduction to CAD/CAM, Historical developments, Industrial look at CAD/CAM, Introduction to CIM; Basics of geometric and solid modeling, explicit, implicit, intrinsic and parametric equations, coordinate systems.

Unit-II: Transformations
Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, orthographic and perspective projections, reconstruction of 3-D objects.

Unit-III: Curves
Algebraic and geometric forms, tangents and normal, blending functions reparametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves.

Unit-IV: Surfaces
Algebraic and geometric forms, tangents and normal, blending functions, reparametrization, sixteen point form, four curve form, plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, bezier surface, B-spline surface.

Unit-V: Solids
Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition, spatial occupancy enumeration.

Unit-VI: Finite Element Modeling

Types of FE analysis; Degree of freedom; Influence coefficient; Element and stiffness equations; Application of FE analysis to 1-D thermal problem; Assembly procedure; General structure of a FE analysis procedure.

Books:

1. CAD/ CAM by Groover and Zimmer, Prantice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Mathematical Elements for computer Graphics by David F. Rogers and J. Alan Adams, McGraw Hill, New York.

References:

1 CAD/CAM (Principles, Practice & Manufacturing Management) by Chirs Mc Mohan & Jimmie Browne, Published by Addison- Wesley.

Note: In the semester examination, the examiner will set eight questions in all, at least one question from each unit. The students will be required to attempt only 5 questions.

MAHARSHI DAYANAND UNIVERSITY
ROHTAK

ME- 444- E ERGONOMICS AND WORK PLACE DESIGN

L	T	P
4	-	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs.

Unit-I: Basic Principles of Ergonomics
Anthropometry, Posture and Health; Anthropometry Practical; Displays, Controls and HMI; Tools and Equipment Design; Workplace Design and Assessment; Task Analysis; Questionnaire and Interview Design; Product Design and Evaluation; Designing for manufacture and maintenance; Health and Safety Legislation and Ergonomics.

Unit-II: Application of Ergonomics Principles
Cognitive Ergonomics, Human Information Processing; Memory; Reading; Perception; Navigation; Problem Solving; Decision Making, Human-Computer Interaction, Input/Output Technology, Usability; Evaluation; Health problems.

Unit-III: Future Systems
Job Design, Scientific Management, Enrichment, Enlargement, Rotation, Cells, Shift work, Management Style and Job Design, Change Management. New Technology, Unemployment, Deskilling, Introducing new technology. Questionaire design and assessment. Task analysis techniques. Measurement of human error and risk. Use of simulation and prototypes. Product Evaluation. Experimental Design.

Unit-IV: Case Studies
A set of case studies will be used to demonstrate how ergnomics has lead to changes in work activity, safety and product design. Case studies will include advanced computer applicatons, workplace assessment and re-design, accident analysis and industrial inspection, and in manufacturing. Students will be required to apply the principles to a real life ergonomic design as applied to a product, service or computer application.

Books:

1. Work Design: Industrial Ergonomics – Knoz, Stephan A., Johnson, Steven, Holcomb Hathaway, Scottsdale, AZ.
2. Human factors in engineering and design by Sanders, M.S. & McCormick, E.J., 6th ed., McGraw-Hill, New York.

References:

1. Ergonomics: Man in his working environment- Murrell, K.F.H, Champan & Hall, London.
2. Man – Machine Engineering – Chapanis A: Wordsworth Publishing Co.
3. The Practice and Management of Industrial Ergonomics – Alexander, D.C., Prentice-Hall, Englewood Cliffs, NJ.
4. Textbook of Work Physiology – Astrand, P.O. & Rhodahl, K.– McGraw-Hill, New York.
5. Human Factors in Lighting – Boyce, P.R. Macmillan, New York.
6. The Ergonomics of Workspaces and Machines : A design manual – Clark, T.S. & Corlett, E.N. Taylor & Francis, London.
7. Ergonomics at work. Oborne, D Wiley, London.
8. Bodyspace–Anthropometry, Ergonomics and Design. – Pheasant, S. Taylor & Francis,.

Note: In the semester examination, the examiner will set eight questions in all, taking at least two questions from each unit. The students have to attempt 5 questions.

MAHARSHI DAYANAND UNIVERSITY

ROHTAK

ME-446E MODERN MANUFACTURING PROCESSES

L	T	P
4	-	-

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs.

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

Unit-II: Electrochemical and Chemical Metal Removal Processes
Electrochemical Machining- Elements of ECM process, tool work gap, chemistry of the process, metal removal rate, accuracy, surface finish and other work material characteristics, economics, advantages, applications, limitations. Electrochemical Grinding - Material removal, surface finish, accuracy, advantages, applications.

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

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

Books:

1. Modern Machining Processes – P.C.Pandey, H.S.Shan, Tata McGraw Hill
2. Machining Science- Ghosh and Malik, Affiliated East-West Press

References:

1. Non Traditional Manufacturing Processes- Benedict G.F, Marcel Dekker
2. Advanced Methods of Machining- Mc Geongh J.A, Chapman and Hall

Note: In the semester examination, the examiner will set eight questions in all, taking at least 2 questions from each unit. The students will be required to attempt only five questions.