Course Title:	**Air Conditioning and Refrigerating (1)(620543)**
Prerequisite: (620441)	**Thermodynamics (2) (620342) + Heat Transfer I**
Text Book:	**Principles of Heating, Ventilating and Air Conditioning, R. Howell et al., ASHRAE, 1998**
Level:	**5th year** **Credit Hours: 3**

Course Goals:
To learn the student how to design the air conditioning and refrigerating systems

Time Schedule:
Duration: 16 Weeks **Lectures:** 3 hours / week
Tutorial: 0 hour / week **Laboratories**: 0 hours / week

Objectives:
At completing this course the student should be able to:
- Determine the comfort conditions in different applications.
- Estimate the heating and cooling loads for the required design.
- Design the water and air distribution systems.
- Select the appropriate air conditioning system components such as pumps, fans, furnaces, boilers, etc….

Course Contents

	Week
• **Introduction to Air Conditioning Systems.**	**1**
• **Psychrometry, Conditioning Processes and Comfort Conditions.**	**3**
• **Heat Transfer in Buildings.**	**1**
• **Heating Load Calculation.**	**2**
• **Cooling Load Calculation.**	**2**
• **Energy Calculations.**	**1**
• **Flow, Pumps, and Piping Design.**	**3**
• **Underfloor Heating**	**1**

Mode of Assessment

1. **First exam:** **(20%)**
2. **Second exam:** **(20%)**
3. **Reports, H. works, and/or Projects** **(10%)**
4. **Final exam:** **(50%)**

References

1. Heating and Air Conditioning, M. Alsaad and M. Hammad, Third Edition, Amman, Jordan, 2001.
2. Heating and Cooling of Buildings, J. Kreider, P. Curtiss and A. Rabi, Second Edition, McGraw-Hill, 2002.

Course Title:	**Air Conditioning and Refrigerating II (620544)**
Prerequisite:	**Air Conditioning-1 (620543)**
Text Book:	**Principles of Heating, Ventilating and Air Conditioning, by H.J. Sauer, Jr. and R.H. Howell: published by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), 2001.**
Level:	**5th year** **Credit Hours: 3**

Course Goals:

To introduce the student into the design of air conditioning systems for common buildings. He is expected to gain knowledge and understanding of selecting proper design conditions, calculating the cooling load and designing the air-duct distribution network. The student is to be also introduced to air conditioning system selection and will have a brief knowledge of air processing equipment.

Time Schedule:

Duration: 16 Weeks
Lectures: 3 hours / week
Tutorial: 1 hour / week
Laboratories: None

Objectives:

A student completing this course should be able to:

1- Apply the basic concepts of heat transfer, fluid mechanics and thermodynamics in the design of air conditioning systems.

2- Realize local and international design criteria and codes for indoor and outdoor conditions.
3- Calculate the cooling load.
4- Size the air ducts and calculate the pressure drop in the system.
5- Size and select the proper fan and other air conditioning plant components.

Course Contents

	Weeks
❑ Review of basic concepts: Psychrometrics.	2
❑ Basic HVAC calculations.	1
❑ Design conditions.	2
❑ Cooling load.	2
❑ Residential cooling load.	1
❑ Non residential cooling load.	2
❑ Duct and pipe sizing.	3
❑ Air conditioning systems.	2

Method of Assessment

5. **First exam: (20%)**
6. **Second exam and project: (20%)**
7. **H. works, and class activity (10%)**
4. **Final exam: (50%)**

References

1. ASHRAE Handbook, Latest editions, American Society of Heating, Ventilating and Air Conditioning Engineers.
2. Grimm N.R., Rosaler R.C., “Handbook of HVAC Design”, McGraw-Hill, 1995.

Course Title:	**Applied Mechanics (620214)**
Prerequisite:	**Engineering Mathematics (630101)**
Text Book:	**1.Engineering Mechanics, Statics. J.L. Meriam & L.Gkraige, Wiley. 2.Engineering Mechanics, Dynamics. J.L.Meriam & L.Gkraige, Wiley. 3.elements of strength of materials, S.P. Timoshenko & D.H.Young, East-West Edition.**
Level:	**4th year** **Credit Hours: 3**

Course Goals:
To build a foundation of analytical capability for the solution of engineering problems that describe force and motion.

Time Schedule:
Duration: 16 Weeks **Lectures:** 3 hours / week

Objectives:
At completing this course the student should be able to:
- Analyze and solve problems containing equilibrium of rigid bodies.
- Solve problems concerning force, acceleration energy, and momentum.
- Solve problems concerning the behavior of structural membranes under external loads.
- Determine the limiting loads which the member can stand before failure.

Course Contents

	Week
• **Statics of a particle.**	**1**
• **Rigid bodies: equivalent system of forces.**	**2**
• **Equilibrium of rigid bodies.**	**3**
• **Distributed forces: moment of inertia.**	**2**
• **Kinematics of rigid bodies.**	**2**
• **Plane motion of rigid bodies: forces and acceleration.**	**3**
• **Plane motion of rigid bodies: energy and momentum.**	**3**

Mode of Assessment

8. **First exam:** **(20%)**
9. **Second exam:** **(20%)**
10. **Reports, H. works, and/or Projects** **(10%)**
11. **Final exam:** **(50%)**

References

1. Engineering Mechanics, Statics. R.C. Hibbeler, Prentice Hall.
2. Engineering Mechanics, Dynamics. R.C.Hibbeler, Prentice Hall.

Course Title: Automatic control (620452)
Prerequisite: Actuators and Sensors (640364), Electronics (610304)
Text Book: Automatic Control Systems, Benjamin C.Kuo,7th ed. Willy
Level: 4th year **Credit Hours: 3**

Course Goals:
To introduce the students to the linear feed back control theory.

Time Schedule:
Duration: 16 Weeks Lectures: 3 hours / week

Objectives:
At completing this course the student should be able to:

- Model physical systems.
- Analyze control systems.
- Test for the stability of control systems using different techniques.

Course Contents

		Weeks
❑	Linear Feedback control Theory; Laplace Transfers	1
❑	Mathematical modeling of Physical systems	2
❑	Transfer Functions, Block diagrams and signal flow graphs	3
❑	Time Domain Analysis of control systems	2
❑	Control System Design by Root-Locus Technique	2
❑	Time Domain Design of control Systems	3
❑	Frequency-Domain analysis	3

Mode of Assessment

1. First exam (20%)
2. Second exam (20%)
3. Reports, H. works, and/or Projects (10%)
4. Final exam (50%)

References

1. Modern Control Engineering, Katsuhiko Ogata, 4th ed. Wiley
2. Automatic Control Engineering, Francis H. Raven. McGraw-Hill.
3. Modern Control systems, Richard C. Dorf. And Robert H. Bishop. Prentice Hall
4. Control System Engineering, William J. Palm III, Willy

Course Title: Automotive principles (620105)
Prerequisite: Non
Text Book: Automotive Technology; Vocational Training Saudi Arabia
Level: Any Year **Credit Hours: 3**

Course Goals:
To introduce the students to Automotive Principles and maintenance
Time Schedule:
Duration: 16 Weeks Lectures: 3 hours / week
Objectives:
At completing this course the student should be able to:

- Recognize automotive parts and know the names in Arabic and English
- Know how the different systems work
- Know the maintenance procedure of the different systems
- Know how to troubleshoot the different malfunctions

Course Contents

	Weeks
❑ Introduction to Automotive Technology	1
❑ General description to engine Parts	1
❑ Engine Systems	6
❑ Ignition, Fuel, Lubrication, Cooling, Exhaust, and Emission	
❑ Power terrain Systems; Clutch, Transmission, Axis and Drives	2
❑ Braking System	1
❑ Steering and Suspension systems	1
❑ Wheels and Tires and their maintenance	1
❑ Most common vehicle malfunctions diagnoses	1

Mode of Assessment

5. First exam (20%)
6. Second exam (20%)
7. Reports, H. works, and/or Projects (10%)
8. Final exam (50%)

References

5. Auto Fundamentals; M. Stockel, M. T. Stockel, C. Johanson
6. Modern Automotive Technology, James E. Duffy.
7. A.A Book of the Car. British Automobile Association.

Course Title: Design of Sanitary Systems (620532)

Prerequisite:	**Fluid Mechanics I (620331)**
Text Book:	**Plumbing Technology, By F. Hall, Longman Scientific and Technical, 1987 and collected notes**
Level:	**5th year** **Credit Hours: 3**

Course Goals:

To give the students the most important knowledge about all mechanical systems used in buildings.

Time Schedule:

Duration: 16 Weeks **Lectures:** 3 hours / week

Tutorial: 0 hour / week **Laboratories**: 0 hours / week

Objectives:

At completing this course the student should be able to understand the :

- Design of hot and cold water supply.
- Water sources
- Basics of heating systems
- Drainage systems .
- Sanitary appliances
- Fire fighting systems.
- Pipe sizing.

Course Contents

	Weeks
• **Basic definitions and terms.**	**1**
• **Cold water supply, plumping materials and valves.**	**2**
• **Hot water supply.**	**1**
• **Pipe sizing for hot and cold-water installation.**	**1**
• **Low – pressure – hot – water heating.**	**2**
• **Drainage systems design.**	**2**
• **Sanitary applications.**	**2**
• **Storm water drains.**	**1**
• **Fire fighting networks.**	**2**

Mode of Assessment

9. **First exam:** **(20%)**
10. **Second exam:** **(20%)**
11. **Reports, H. works, and/or Projects** **(10%)**
12. **Final exam:** **(50%)**

References

- **Cold water supplies, drainage and sanitation, By F. Hall Longman scientific and technical.**
- **Building services and equipment, By F. Hall Longman scientific and technical**

Course Title:	**Dynamics (620212)**
Prerequisite:	**Static (620211)**
Text Book:	**Dynamics, R. C. Hibbeler, 9th Edition, Prentice Hall, New Jersey.**
Level:	**2nd year** **Credit Hours: 3**

Course Goals:

To study of the behavior of bodies in motion, including the kinematics and kinetics of particles, systems of particles, and rigid bodies in plane motion. Kinetics problems are solved by direct applications of Newton's Laws and by use of energy and momentum methods.

Time Schedule:

Duration: 16 Weeks **Lectures:** 3 hours / week

Tutorial: 0 hour / week **Laboratories**: 0 hours / week

Objectives:

At completing this course the student should be able to:

1. Relate time, position, velocity, and acceleration of particles using rectangular components, normal and tangential components, and cylindrical components.

2. Solve particle kinetics problems using Newton's 2nd Law, work-energy methods, and impulse-momentum methods.

3. Use vectors to describe the motion of a rigid body undergoing translation, rotation about a fixed axis, and general plane motion.

4. Use Newton's law and work-energy methods to solve kinetics problems involving coplanar motion of a rigid body.

Course Contents

	Week
• Kinematics of a particle.	2
• Kinetics of a particle: Force and acceleration.	2
• Kinetics of a particle: Work and energy.	2
• Kinetics of a particle: Impulse and momentum.	2
• Planar kinematics of a rigid body.	2
• Planar kinetics of a rigid body: Force and acceleration	2
• Planar kinetics of a rigid body: Work and energy	1
• Planar kinetics of a rigid body: Impulse and momentum	1

Mode of Assessment

13. First exam: (20%)
14. Second exam: (20%)
15. Reports, H. works, and/or Projects (10%)
16. Final exam: (50%)

References

1. Vector Mechanics for Engineers: Dynamics, 5th Ed., Beer and Johnston
2. Engineering Mechanics: Dynamics, 2nd Ed., Pytel and Klusalaas

Course Title:	**Energy Conversion (620581)**
Prerequisite:	**Thermodynamics-2 (620342)**
Text Book:	**Principles of Energy Conversion, by Archie W. Culp, Jr. 2nd. Ed., McGraw-Hill**
Level:	**5th. year** **Credit Hours: 3**

Course Goals:

To introduce the student into the economical, global and engineering aspects of energy and its conversion technologies.

Time Schedule:

Duration: 16 Weeks **Lectures:** 3 hours / week

Tutorial: 1 hour / week **Laboratories**: None

Objectives:

1. Identify energy consumption and utilization features on the global, regional and local levels.
2. Predict energy consumption in a certain country given the growth rate is known.
3. Analyze and calculate energy costs for a certain power plant and find the breakeven point for that plant.
4. Figure out various properties, including the heating values for a mixture of gaseous, liquid and solid fuels.
5. Calculate theoretical and actual air/fuel ratios for the combustion of various kinds of fuels, especially coals, given their analysis are known.
6. Select basic draft systems for a power plant.
7. Estimate boiler efficiency.
8. Assess environmental impact of power plant operation.
9. Size and select a solar collector, a photovoltaic panel and a windmill.
10. Size an energy storage system.

Course Contents

	Weeks
1- Energy classification, resources and utilization.	1
2- Principal fuels for energy conversion.	2
3- Production of thermal energy.	2
4- Fossil fuel systems.	2
5- Environmental impact of power plant operation.	1
6- Production of electrical energy(by direct energy conversion).	2
7- Wind energy.	1
8- Solar energy.	3
9- geothermal energy.	1
10- Energy storage and conservation.	1

Method of Assessment

17. **First exam:** **(20%)**
18. **Second exam:** **(20%)**
19. **Homeworks and quizzes** **(10%)**
20. **Final exam:** **(50%)**

References

1. Energy Technology Handbook, by D.M. Considine; Editor-in-chief, McGraw-Hill, Latest Edition.
2. Weston, K.C., “Energy Conversion”, West Publishing Co., 1992.

Course Title:	**Engineering Drawing (620121)**	
Prerequisite:	**Non**	
Text Book:	**Engineering Design Graphics, By: Earle, James 10th edition.**	
Level:	**1st year**	**Credit Hours: 3**

Course Goals:
The main purpose of this course is to develop the ability to visualize an object with physical and dimensional configurations. Computer–aided Drafting (CAD) is introduced using CAD software.

Time Schedule:
Duration: 16 Weeks **Lectures:** 6 hours / week

Objectives:
At completing this module the student should be able to:
- Understand Engineering Drawings.
- Introduce students to the skills required to make drawings and freehand sketches.

Course Contents

Manual	ACAD	Weeks
o Course Introduction.	o ACAD Introduction	1
o Lettering, Use of Instruments, Scales.	o Setting Screen, Parameters, Limits, Grid, Snap, Units, Text	1
o Types of lines	o Draw commands, Point, Line, Circle, arc,…etc	1
o Basic geometric Construction	o Draw and Edit commands, Ellipse, Ploygon, donut, Solid, Erase.	1
o Tangents	o Object Snap Commands, Inquiry	1
o Conical Sections	o Modify commands I (Fillet, Chamfer, Change, Array…etc)	1
o Introduction to Projection	o Modify Commands II (Mirror, Offset, Break,…)	1
o Points, Lines & Planes	o Viewing Commands	1
o Orthographic Projection.	o Layers, Blocks	1
o Points & Lines in planes, visibility of lines, rue length of a line, Slope of a line.	o Object properties	1
o Point View, Edge View	o Hatch Commands	1
o True size of a plane, dihedral angle	o Pline, Pedit	1
o Sections(full, Half, Offset)	o Dimensioning	1
o Sections (Remove, Revolve Broken out)	o Dimension Styles & Dimension Variables	1
o Dimensioning	o Isometric, UCS Commands	1
o Isometric drawing	o Plotting	1

Mode of Assessment

21. **First exam:** **(20%)**
22. **Second exam:** **(20%)**
23. **H. works** **(20%)**
24. **Final exam:** **(40%)**

References

8. G.F. Pearce, “Engineering Graphics and Descriptive Geometry in 3-D”, McGraw-Hill., 1980.
9. Thomas E. French, Charles J. Vierck, Robert J. Foster “Engineering Drawing And Graphic Technology” Thirteenth Edition, McGraw-Hill.

Course Title	**:**	**Fluid Mechanics I**	**(620331)**
Prerequisites	**:**	**Engineering Analysis I**	**(630201)**
		Dynamics	**(620212)**
Text Book	**:**	**Engineering Fluid Mechanics, by Roberson and Crowe, Houghton Mifflin, Lasted edition (6-Th).**	
Credit Hours	**:**	**3**	**Level 3rd Year**

Course Goals:

To cover the basic concepts of fluid mechanics.

Time Schedule:

Duration:	16 Weeks	**Lectures:**	3 Hours / Week
Tutorial:	0 Hour / Week	**Laboratories:**	0 Hours / Week

Objectives:

At completing this course the student should be able to understand the:

1-	Fluid properties
2-	Fluid governing equations
3-	Dimensional analysis and similitude

Course Contents

		Week
❖	Fluid Properties	2
❖	Hydrostatics	2
❖	Flow Visualizations.	2
❖	One Dimensional Continuity, Bernoulli's, Euler's and Energy Equations	4
❖	Impulse & Momentum Principales	2
❖	Dimensional Analysis	2
❖	Surface Resistance	2

Mode of Assessment

1	First Exam	20%
2	Second Exam	20%
3	Reports\Homeworks\ and or Projects	10%
4	Final Exam	50%

References

1 Fundamentals of Engineering Fluid Mechanics, by Gerhard, Gross, Addison-Wesley, Latest edition.

2 Fluid Mechanics, by Douglas, Gasiorek, Swaffield, Pitman, Lasted edition.

Course Title:	**Fluid Mechanics II (620431)**
Prerequisite:	**Fluid Mechanics I (620331)**
Text Book:	**Engineering Fluid Mechanics, by Robertson and Crowe, Houghton Mifflin, Lasted edition (6-Th).**
Level:	**4th year** **Credit Hours: 3**

Course Goals:
To cover more advanced material in fluid mechanics

Time Schedule:
Duration: 8 Weeks **Lectures:** 3 hours / week
Tutorial: 0 hour / week **Laboratories**: 0 hours / week

Objectives:
At completing this course the student should be able to understand the :

- Pipes networks
- Basics of drag and lift
- Compressible fluid flow
- Open channel flow.

Course Contents

Weeks

- ✓ **Surface resistance of uniform flow and turbulent boundary layer, relations for both laminar and turbulent boundary layer. 1**
- ✓ **Fluid flow in pipes and conduits: laminar and turbulent flow in pipes. Flow in pipes and fittings, pipe systems. 1**
- ✓ **Drag and lift: basic considerations, two and three dimensional bodies and ax symmetric bodies, vortex shedding, streamlining, terminal velocity and lift. 1**
- ✓ **Compressible fluid flow. 2**
- ✓ **Varied flow in open channels.**1
- ✓ **Flow Measurements and Introduction to turbo- machinery 1**

Mode of Assessment

- **First exam: (20%)**
- **Second exam: (20%)**
- **Reports, H. works, and/or Projects (10%)**
- **Final exam: (50%)**

References

- **Fundamentals of Engineering Fluid Mechanics, by Gerhard, Gross, Addison-Wesley, Latest edition.**
- **Fluid Mechanics, by Douglas, Gasiorek, Swaffield, Pitman, Lasted edition.**

Course Title: Heat Transfer I (620441)
Prerequisite: Fluid Mechanics (1) (620331), Thermodynamics (1) (620341)
Text Book: Fundamentals of Heat and Mass Transfer, P. Incropera & Dewitt, Wiley, 5th Edition
Level: 4th year **Credit Hours: 3**

Course Goals:
To learn the student the basic concepts of heat and mass transfer

Time Schedule:
Duration: 08Weeks **Lectures:** 3 hours / week
Tutorial: 0 hour / week **Laboratories**: 0 hours / week

Objectives:
At completing this course the student should be able to understand the:
- Introduction to heat transfer modes and energy balance.
- One and two -Dimensional conduction
- Heat transfer in extended surfaces-Fins.
- Transient conduction
- Introduction to convection process

Course Contents

	Week
• **Introduction to Heat Transfer (Modes, Energy and Analysis**	**1**
• **Introduction to conduction: conduction rate equation, thermal conductivity, heat diffusion, equation, and boundary and initial conditions**	**1**
• **One-dimensional steady-state equation: plane wall, radial system, and conduction with heat generation, application of thermal resistance, and heat transfer from external surfaces**	**1**
• **Tow-dimensional steady-state conduction, method of separation variables, graphical method, finite differences equations, and solution.**	**1**
• **Transient conduction: One-dimensional unsteady state heat conduction: Mathematical approach, lumped capacitance method**	**2**
• **Introduction to convection: convection boundary layer, laminar and turbulent flow convection transfer equation, velocity and thermal boundary layer 1 similarity.**	

Mode of Assessment

25. **First exam:** **(20%)**
26. **Second exam:** **(20%)**
27. **Reports, H. works, and/or Projects** **(10%)**
28. **Final exam:** **(50%)**

References

1. **Heat Transfer, J.P. Holman, S.I. Metric edition, Mc-Graw Hill, Latest Edition.**
2. **Heat Transfer, Martin Becker, Plenum Press, Latest Edition.**

Course Title:	**Heat Transfer II (620442)**	
Prerequisite:	**Heat Transfer I (620441)**	
Text Book:	**Fundamentals of Heat and Mass Transfer, P. Incropera & Dewitt, Wiley, 5th Edition**	
Level:	**4th year**	**Credit Hours: 3**

Course Goals:
To learn the student how to design thermal systems

Time Schedule:

Duration: 16 Weeks
Lectures: 3 hours / week
Tutorial: 0 hour / week
Laboratories: 0 hours / week

Objectives:
At completing this course the student should be able to understand the :

- Thermal design of heat exchanger.
- Basic principles of thermal radiation.
- Convection process.
- Internal and external flow.

Course Contents

	Week
• **Introduction to Convection.**	**1**
• **External Flow.**	**2**
• **Internal Flow.**	**2**
• **Free Convection.**	**2**
• **Boiling and condensation.**	**2**
• **Heat Exchangers.**	**2**
• **Radiation - Processes and Properties.**	**2**

Mode of Assessment

29. **First exam:** **(20%)**
30. **Second exam:** **(20%)**
31. **Reports, H. works, and/or Projects** **(10%)**
32. **Final exam:** **(50%)**

References

1. Heat Transfer, J.P. Holman, S.I. Metric edition, Mc-Graw Hill, Latest Edition.
2. Heat Transfer, Martin Becker, Plenum Press, Latest Edition.

Course Title:	**Hydraulic Machines (620531)**
Prerequisite:	**Fluid Mechanics I (620331)**
Text Book:	**Collected materials from several text books**
Level:	**5th year** **Credit Hours: 3**

Course Goals:
To learn the student the design and the design and the operation of turbo machines

Time Schedule:

Duration: 16 Weeks **Lectures:** 3 hours / week
Tutorial: 0 hour / week **Laboratories**: 0 hours / week

Objectives:
At completing this course the student should be able to understand the:

- The jet theory
- The construction of turbo machines
- The hydrodynamic design
- The system matching
- Types of machines

Course Contents

	Week
General theory of machinery.	**1**
Jets theory.	**1**
Impulse and reaction pressure turbines. (Kaplan, Pelton Francis turbines)	**5**
Introduction of hydrodynamic pumps. (Centrifugal-radial, Axial, mixed flow pumps)	**3**
Application of Similarity to hydrodynamic machines	**2**
Hydraulic machines Design.	**1**
Positive displacement pumps. (Gear, Lobe, van pumps...etc.)	**2**
Pipelines networks.	**2**

Mode of Assessment

- **First exam: (20%)**
- **Second exam: (20%)**
- **Reports, H. works, and/or Projects (10%)**
- **Final exam: (50%)**

References

- **Hydraulic & compressible flow turbomachines, A.T.Sayers,McGraw Hill 1990**
- **Pump Handbook, Igor Karassik, Mc Graw Hill 1986**

Course Title: Internal Combustion Engines (620541)
Prerequisite: Thermodynamics(2) (620342),Heat Transfer(1) (620441)
Text Book: Engineering Fundamentals of the Internal Combustion Engine, By W. W. Pulkrabek
Level: 5th year **Credit Hours: 3**

Course Goals:
Provides the material needed for the basic understanding of the operation of the internal combustion engines.

Time Schedule:
Duration: 16 Weeks **Lectures:** 3 hours / week

Objectives:
At completing this module the student should be able to:
- Recognize the basic types of internal combustion engines.
- Estimate the performance of internal combustion engines
- Know the fundamental thermo chemistry as applied to fuels.
- Follow the various operational processes from intake to exhaust.
- Be familiar with cooling and lubrication systems.

Course Contents

	Weeks
❑ Introduction to Internal Combustion Engines	1
❑ Engine Design and Operating Parameters	2
❑ Air-Standard Cycles	3
❑ Thermo chemistry and Fuels	2
❑ Fuel Motion Within Combustion Chamber	1.5
❑ Combustion in SI and CI Engines	1.5
❑ Exhaust Flow	1.5
❑ Air Pollution	1.5
❑ Engine Cooling and Lubrication	2

Mode of Assessment

First exam:	**(20%)**
Second exam:	**(20%)**
Reports, H. works, and/or Projects	**(10%)**
Final exam:	**(50%)**

References

1. Internal Combustion Engines, By Ferguson
2. Internal Combustion Fundamentals, By John B. Heywood
3. Internal Combustion Engine in Theory and Practice, By P. L. Ballaney
4. Internal Combustion Engines and Air Pollution, By F. D. Obert
5. Internal Combustion Engines, By V. Ganesan, 10th ed.

Course Title:	**Machine Design I (620421)**
Prerequisite:	**Solid Mechanics (620213)** **Theory of Machines (620321)**
Text Book:	**Shigley and Mischke (2003) Mechanical Engineering Design, 7th Edition, McGraw Hill**
Level:	**4th year** **Credit Hours: 3**

Course Goals:

Introduction to design process, Design considerations, Stress analysis in machine elements and deflection, failure of machine elements, Fatigue, Power screws and threaded fasteners, Welded joints and riveted joints, Mechanical springs.

Time Schedule:

Duration: 16 Weeks **Lectures:** 3 hours / week
Tutorial: 1 hour / week **Laboratories**:

Objectives:

At completing this module the student should be able to:

1. Go through the design process and consideration cycle.
2. Perform stress and deflection analysis of a machine element.
3. Apply the different theories of failure in element design.
4. Find the fatigue life or safe fatigue load on a machine element.
5. Model and design power screws and bolted connections.
6. Analyze and design riveted shear connections.
7. Analyze and design welded connections.
8. Design and select helical spring parameters for stated requirements.

Course Contents

	Weeks
❑ Introduction to mechanical engineering design.	2
❑ Stress analysis.	3
❑ Deflection analysis.	2
❑ Theories of failure.	2
❑ Design for fatigue strength.	3
❑ Bolts, screws and rivets.	2
❑ Welded connections.	1
❑ Design of mechanical springs.	1

Mode of Assessment

33. **First exam: (20%)**
34. **Second exam: (20%)**
35. **Reports, H. works, and/or Projects (10%)**
36. **Final exam: (50%)**

References

1. Robert L. Mott, 'Machine Elements in Mechanical Design' 3rd Edition.
2. Norton R.L., "Machine Design: An Integrated Approach", Prentice Hall.

Course Title:	**Machine Design II (620422)**
Prerequisite:	**Machine Design I (620421)**
Text Book:	**Shigley and Mischke (2003) Mechanical Engineering Design, 7th Edition, McGraw Hill**
Level:	**4th year** **Credit Hours: 3**

Course Goals:

Design and selection of basic machine elements specifically: Shafting, Rolling element Bearing, Journal bearing, Gearing, Brakes, clutches and coupling, Flexible mechanical elements.

Duration: 16 Weeks **Lectures:** 3 hours / week

Tutorial: 1 hour / week **Laboratories**:

Objectives:

At completing this module the student should be able to:

9. Perform detailed design and selection of power transmission shafts.
10. Select and specify mounting details of different types of rolling element bearings.
11. Design a hydrodynamic journal bearing.
12. Perform kinematics analysis and synthesis of gear trains.
13. Select and specify the dimensional and material gear parameters for specific power transmission requirements.
14. Design and analyze different types of clutches and braking systems.
15. Select flexible power transmission elements.

Course Contents

	Weeks
❑ Review of related material	1
❑ Power transmission shafts .	2
❑ Rolling element bearing.	2
❑ Journal bearings.	1
❑ Gearing.	6
❑ Clutches, brakes and couplings.	2
❑ Flexible power transmission elements.	2

Mode of Assessment

37. **First exam: (20%)**
38. **Second exam: (20%)**
39. **Reports, H. works, and/or Projects (10%)**
40. **Final exam: (50%)**

References

1. Robert L. Mott, 'Machine Elements in Mechanical Design' 3rd Edition.
2. Norton R.L., "Machine Design: An Integrated Approach", Prentice Hall.

Course Title:	**Mechanical Drawing.**	**(620221) Prerequisite: Engineering Drawing (620121)**
Level:	**3rd year**	**Credit Hours: 2**

Course Goals:
To teach the student how to draw the mechanical components manual and using Mechanical Desktop.

Time Schedule:
Duration: 16 Weeks **Sessions:** 6 hour / week

Objective:
Completing this course the student should be able to understand the:
- Drawing in 2-dimension
- Drawing in 3-dimension
- Using Mechanical Desktop
- Drawing the mechanical components and Assembly.

Course Contents

	Weeks
❑ **Dimensioning**	**1**
❑ **Sectioning**	**1**
❑ **ISO Metric Screw Threads**	**2**
❑ **Limits & Fits**	**2**
❑ **Auxiliary view**	**2**
❑ **Isometric drawing**	**3**
❑ **Assembly drawing**	**5**

Mode of Assessment

1. **First Exam: (Manual)** **(20%)**
2. **Second Exam: (Mechanical Desktop)** **(20%)**
3. **Homework's:** **(20%)**
4. **Final Exam (Manual + Mechanical Desktop):** **(40%)**

References

10. T. E. French, C.L. Svensen and J.D. Halsel, "Mechanical Drawing".
11. Tamta G.L., "Mechanical Draughtsmanship: a text forI.T.I. and Diploma Students", Dhanpat Rai & Sons.

Course Title:	**Mechanical vibrations**	**(620471)**
Prerequisites:	**Dynamics**	**(620212)**
	Engineering Analysis (1)	**(630201)**
Text Book:	**Mechanical vibrations, by Rao S., Addison Wesley, 3rd Edition, 1995.**	
Level:	**4th year**	**Credit Hours: 3**

Course Goals:
To introduce the principles of vibrations modeling and its control.

Time Schedule:
Duration: 16 Weeks
Tutorial: 0 hour / week
Lectures: 3 hours / week
Laboratories: 0 hours / week

Objectives:
At completing this module the student should be able to:

- understand the basic concepts vibrations phenomenon.
- Single and multi-degrees of freedom vibrations.
- Vibration measurements and control.

Course Contents

	Weeks
➢ **Fundamentals of vibration**	**1**
➢ **Free vibration of single DOF**	**2**
➢ **Harmonically excited vibration**	**2**
➢ **Two DOF systems**	**2**
➢ **Multi-Degree of freedom system**	**2**
➢ **Natural frequencies and mode shape**	**2**
➢ **Continuous systems**	**2**
➢ **Vibration measurement and applications**	**1**
➢ **Vibration control**	**2**

Mode of Assessment

1. **First Exam** **(20%)**
2. **Second Exam** **(20%)**
3. **Reports, Home works and /or projects** **(10%)**
4. **Final Exam** **(50%)**

References

1. An Introduction to mechanical vibrations, R. Steidel, 4th edition, Wiley, 1989.
2. Tse F.S., “The Mechanical Vibrations: Theory and Applications”, Prentice Hall, 1978.

Course Title:	**Power Hydraulics**	**(620533)**
Prerequisite:	**Thermodynamics II**	**(620331)**
	Heat Transfer I	**(620441)**
Text Book:	**Fluid Power with Applications, By: A. Eposito , 5th ed.**	
Level:	**5th year**	**Credit Hours: 3**

Course Goals:
To introduce the principles for designing fluid power systems and their applications.

Time Schedule:
Duration: 16 Weeks **Lectures:** 3 hours / week

Objectives:
At completing this module the student should be able to:
- Understand the theoretical basis for fluid power systems.
- Be familiar with the main components of fluid power systems
- Developing circuit design and analysis.
- Be familiar with the principles of control of fluid power systems.

Course Contents

	Weeks
❑ Introduction to fluid power	1
❑ Physical properties of hydraulic fluids	1
❑ Energy and power in hydraulic systems	1
❑ Hydraulic conductors and flow in pipes	1
❑ Hydraulic pumps	1.5
❑ Hydraulic actuators and motors	1.5
❑ Valves and control components	1.5
❑ Hydraulic circuit design and analysis	2
❑ Accessories and maintenance of hydraulic system	1
❑ Pneumatic components and circuits	1.5
❑ Control of fluid power systems	2
	2

Mode of Assessment

First exam:	**(20%)**
Second exam:	**(20%)**
Reports, H. works, and/or Projects	**(10%)**
Final exam:	**(50%)**

References

1. Power hydraulics, By J. Ashby, Edited by Prentice Hall, 3rd edition

2. Hydraulics for Engineering technology, By J. E. Johnson, Edited by Prentice Hall

3. Hydraulics and Pneumatics, B A. Parr, Edit. Butterworth Heinemann

Course Title:	**Production Processes (620461)**
Prerequisite:	**Properties of Engineering Materials (620361)**
Text Book:	**Manufacturing Processes for Engineering Materials, S. Kalpakjian, ,3rd Edition.**
Level:	**3rd year** **Credit Hours: 3**

Course Goals:
To introduce the students into different manufacturing processes.

Time Schedule:
Duration: 16 Weeks **Lectures:** 3 hours / week
Tutorial: 0 hour / week **Laboratories**: 1 hour / week

Objectives:
At completing this course the student should be able to:
- Understand different types of mechanical behavior of materials.
- Classify the forming processes with respect to temperature & strain rate.
- Understand the following forming processes: forging, rolling, extrusion & rod drawing.
- Calculate the energy & press capacity required for the previous processes.
- Understand the mechanics of metal removing processes.
- Calculate the power in turning & milling processes.
- Understand the vibrations involved in machine tool.

Course Contents

	Week
• Classification of the different manufacturing processes.	**1**
• The mechanical behavior of metals with particular reference to forming & material removal processes.	**3**
• Primary forming processes: forging, rolling, extrusion, rod & wire drawing.	**5**
• Material removal processes:	
Tool materials.	**1**
Mechanics of chip formation.	**1**
Force analysis (Merchant circle).	**1**
• Turning & Milling processes.	**2**
• Vibration & chatter in machine tools.	**2**

Mode of Assessment

41. **First exam:** **(20%)**
42. **Second exam:** **(20%)**
43. **Reports, H. works:** **(10%)**
44. **Final exam:** **(50%)**

References

1. De-Garmo, Paul E., Black, J Temple and Kosher, R.A., Materials and Processes in Manufacturing, Mcmillan, latest edition.
2. Schey J.A., “Introduction to Manufacturing Processes, Prentice Hall.

Course Title:	**Properties of Engineering Materials**	**(620361)**
Prerequisite:	**Solid Mechanics**	**(620213)**
Text Book:	**Fundamentals of Engineering Materials by Peter A. Thornton Vito Colangelo, Prentice Hall**	
Level:	**3rd year**	**Credit Hours: 3**

Course Goals:
To learn the students about structures and properties of materials.

Time Schedule:

Duration: 16 Weeks
Lectures: 3 hours / week
Tutorial: 0 hour / week
Laboratories: 0 hours / week

Objectives:
At completing this course the student should be able to understand the :

- Properties and processing of materials such as semiconductors, electrical ceramics, metals and polymers.
- Strengthening Mechanisms and response to Thermal Treatment and much more.

Course Contents

	Weeks
➢ **The Role of Materials in Engineering.**	**1**
➢ **Review of Atomic Theory and Molecular Structure.**	**1**
➢ **Elements of Crystalline Structure.**	**1**
➢ **Imperfections in Crystalline Materials.**	**1**
➢ **Strengthening Mechanisms and response to Thermal Treatment.**	**2**
➢ **Basic Relationships in Single Phase and Multiphase Materials.**	**1**
➢ **Ferrous Engineering Alloys and their Applications.**	**1**
➢ **Mechanical Testing and Selection of Engineering Materials.**	**2**
➢ **Electrical Properties of Engineering Materials.**	**3**

Mode of Assessment

5. First Exam	**(20%)**
6. Second Exam	**(20%)**
7. Home works and Quizzes	**(10%)**
8. Final Exam	**(50%)**

References

1. Manufacturing Processes for Engineering Materials, S. Kalpakjian, 3rd Edition.
2. Jastrzebski Z.D., “The Nature and Properties of Engineering Materials”, John Wiley & Sons.

Course Title: Solar Energy (620582)
Prerequisite: Heat Transfer I (620441)
Text Book: Solar Engineering of Thermal Processes. By: J. A. Duffie & W. A. Beckman
Level: 5th year **Credit Hours: 3**

Course Goals:
To introduce the principles for designing solar systems and be familiar with their applications.

Time Schedule:
Duration: 16 Weeks **Lectures:** 3 hours / week

Objectives:
At completing this module the student should be able to:
- Understand the theoretical basis for solar systems.
- Be familiar with the main components of solar systems
- Developing design and analysis of typical solar systems.

Course Contents

	Weeks
❑ Solar Radiation	2
❑ Available Solar Radiation	2
❑ Radiation Transmission Through Glazing	2
❑ Flat – Plate Collectors	3
❑ Concentrating Collectors	1
❑ Energy Storage	1
❑ System Thermal calculations	3
❑ Solar Energy Applications	2

Mode of Assessment

First exam:	**(20%)**
Second exam:	**(20%)**
Reports, H. works, and/or Projects	**(10%)**
Final exam:	**(50%)**

References

1. Solar Energy and Energy Conservation, By: Ray Kamal, K. P. Masheswary and P. L. sawhiwey
2. Solar Energy; principles of Thermal Collection and Storage, By: S. P. Sukhatme
3. Solar Energy By: Anderson
4. Passive Solar Heating, By: J. Williams
5. Solar and terrestrial Radiation, By: K. L. Coulson

Course Title:	**Solid Mechanics (620213)**
Prerequisite:	**Statics (620211)**
Text Book:	**Mechanics of Materials, 2nd ed. By Beer & Johnston. International edition, McGraw.Hill, Inc.1992**
Level:	**2nd year** **Credit Hours: 3**

Course Goals:

Studying the Theory of Machine is very important for continuing advance made in the design of Machine and Structures.

Time Schedule:

Duration: 16 Weeks **Lectures:** 3 hours / week

Objectives:

At completing this subject the student should be able to:

- Treatment of the three basic ideas of equilibrium, deformation, and material behavior properties.
- These three ideas are emphasized and kept in focus and careful study of how their combination leads to specific theories about the transmission of forces in typical structural members.

Course Contents

	Weeks
❑ **INTRODUCTION**	**1**
❑ **Stress and strain**	1
❑ **Material behaviors**	**1**
❑ Axial, shear, and bending loads.	2
❑ **Axial, shear, and bending moments diagrams.**	1
❑ **Torsion, circular solid and hollow shafts.**	1
❑ **Stress and deformation.**	**1**
❑ **Deflection of beams, by integration, by moment area method**	**2**
❑ **Stress in two dimensions (combine stress).**	**1**
❑ **Mohr' s Circle.**	**1**
❑ **Thin- wall pressure cylinder.**	**1**
❑ **Buckling.**	**1**
❑ **Energy Methods.**	**1**

Mode of Assessment

45. **First exam:** **(20%)**
46. **Second exam:** **(20%)**
47. **Reports, H. works, quizzes.** **(10%)**
48. **Final exam:** **(50%)**

References

12. Strength of Materials. By: Alexander, 1991.
13. Introduction to mechanics of solids. By Popov. 1968
14. Strength of Materials. By: Ryder 1989.
15. Strength of materials. By: R.C.Stephens. 1974

Course Title	:	**Engineering Mechanics (Statics)**	**(620211)**
Prerequisite	:	**Engineering Mathematics**	**(630101)**
Text Book	:	**Engineering mechanics, By: R. C. Hibbeler 2nd edition, Prentice Hall.**	
Credit Hours	:	**3** **Level 2nd Year**	

Course Goals:			
The main purpose of this course is to provide the student with a clear and through presentation of the theory and applications of engineering mechanics.			
Time Schedule:			
Duration:	16 Weeks	**Lectures:**	3 hours / week
Tutorial:	1 hour / week	**Laboratories:**	---

Objectives:	
At completing this module the student should be able to:	
1-	Understand the statics fundamentals.
2-	Develop Free body diagrams and procedure for Analysis.

Course Contents		
		Week
❖	**General Principles**	1
❖	**Force Vectors**	1
❖	**Equilibrium of a Particle**	1
❖	**Force System Resultants**	2
❖	**Equilibrium of a Rigid Body**	2
❖	**Structural Analysis**	2
❖	**Internal Forces**	2
❖	**Center of Gravity and Centroid**	2
❖	**Moments of Inertia**	2
❖	**Virtual Work**	1

Mode of Assessment		
1	**First Exam**	**20%**
2	**Second Exam**	**20%**
3	**Reports\Homeworks\ and or Projects**	**10%**
4	**Final Exam**	**50%**

References	
1	Das, Kassimali, Sami , “Engineering Mechanics Statics”, IRWIN., 1994.

Course Title:	**Theory of Machine (620321)**	
Prerequisite:	**Dynamics (620212)**	
Text Book:	**Mechanisms and dynamic of machinery, Fourth ed.; by; H.H. Mabie & C.F. Reinholts. Fourth Ed.; John Wiley & sons.**	
Level:	**3rd year**	**Credit Hours: 3**

Course Goals:
Studying the Theory of Machine is very important for continuing advance made in the design of instrumentations, automatic controls.

Time Schedule:
Duration: 16 Weeks **Lectures:** 3 hours / week

Objectives:
At completing this subject the student should be able to:
- Dealings with the Mechanisms of the Machine elements which is concerned with the Kinematics of linkages, Cams, Gears and Gear trains.
- Other analysis of the Machine parameters have been useful in the design of machine elements.

Course Contents

	Weeks
❑ **INTRODUCTION (General dynamics)**	**1**
❑ **Linkages**	2
❑ **Velocity and acceleration diagrams**	**3**
❑ Cams	2
❑ **Crank efforts and Flywheel size.**	2
❑ **Balancing. (rotating and reciprocating masses) .**	**2**
❑ **Gearing and gear trains.**	**2**
❑ **Planetary gear trains.**	**2**

Mode of Assessment

49. **First exam: (20%)**
50. **Second exam: (20%)**
51. **Reports, H. works, and/or Projects (10%)**
52. **Final exam: (50%)**

References

16. Mechanics of Machines , By: Hannah and Stephens.

17. Theory of Machines and Mechanisms , By: Shigley and Uicker.

18. Mechanics of Machines , By: Khurmi and Gupta.

Course Title:	**Thermal Power Plants**	**(620547)**
Prerequisite:	**Internal Combustion Engines**	**(620541)**
Text Book:	**Power Plant Technology, by M.M. El-Wakil, John-Wiley, 1985.**	
Level:	**5th year**	**Credit Hours: 3**

Course Goals:
To introduce the student into real-life thermal power plants. He is expected to gain knowledge and understanding of performance and selection of various components of the plant, including actual cycles.

Time Schedule:
Duration: 16 Weeks
Tutorial: 0 hour / week
Lectures: 3 hours / week
Laboratories: 0 hours / week

Objectives:
At completing this course the student should be able to understand the :

- Understand the theoretical concepts of actual thermodynamic cycles pertaining to thermal power plants.
- Understand the basic concepts, performance and selection of steam generators.
- Calculate, size and select basic steam turbine configurations.
- Size basic types feed water heaters and evaporators.
- Size and select various types of circulating water system components.
- Calculate, size and select basic gas turbine plant configurations.
- Realize environmental impact of power plant operation.

Course Contents

	Weeks
➢ Cycles	3
➢ Steam generators	3
➢ Turbines	2
➢ Condensate feed water systems	2
➢ Circulating water systems	2
➢ Gas turbine and combined cycles	3
➢ Environmental aspects	1

Mode of Assessment

9. First Exam	(20%)
10. Second Exam	(20%)
11. Reports, Home works and /or projects	(10%)
12. Final Exam	(50%)

References

Course Title:	**Thermodynamics I (620341)**
Prerequisite:	**Engineering Mathematics (2) (630102)**
Text Book	**Thermodynamics An Engineering Approach, Yunus Cengel and M. Boles, McGraw Hill, 4rd Edition, 2002.**
Level:	**3rd year** **Credit Hours: 3**

Course Goals:

This course is designed for third year engineering students. It introduces them to the first law and second law of thermodynamics and their applications in engineering problems.

Time Schedule:

Duration: 16 Weeks **Lectures: 3 hours / week**

Objectives:

At completing this course the student should be able to:

- **Identify basic concepts of thermodynamics such as work, heat, energy, control volume, closed and open systems, etc….**
- **Evaluate the properties of pure substances.**
- **Estimate the energy transfer by heat, work and mass.**
- **Apply the first law of thermodynamics on different systems and for different applications.**
- **Understand the concept of entropy.**
- **Apply the second law of thermodynamics on different systems and for different applications.**

Course Contents

	Weeks
✓ Basic Concepts of Thermodynamics	1
✓ Properties and behavior of pure substances	2
✓ Energy Transfer by Heat, Work and Mass	2
✓ First law of Thermodynamics	3
✓ Second law of Thermodynamics	2
✓ Entropy	3

Mode of Assessment

- **First exam (20%)**
- **Second exam (20%)**
- **Reports, H. works, and/or Projects (10%)**
- **Final exam (50%)**

References

- **Fundamentals of Engineering Thermodynamics, M. Moran and H. Shapiro, 3rd Edition, Wiley and Sons, New York, 1998.**
- **Sonntag R.E., Borgnakke C., "Fundamentals of Classical Thermodynamics", John Wiley & Sons.**

Course Title:	**Thermodynamics II (620342)**	
Prerequisite:	**620341**	
Text Book:	**Fundamentals of Engineering Thermodynamics, By: M. J. Moran**	
Level:	**3rd year**	**Credit Hours: 3**

Course Goals:
To enable the student to perform engineering analysis of the main thermodynamic systems

Time Schedule:
Duration: 16 Weeks **Lectures:** 3 hours / week

Objectives:
At completing this module the student should : -
- Be able to perform analysis of thermodynamic systems using the entropy and availability concepts
- Be familiar with the constitution and the operation of the main thermodynamic plants
- Be able to develop the thermodynamic relations used to evaluate the properties of the thermodynamic systems.

Course Contents

	Weeks
❑ Entropy Analysis	2
❑ Availability Analysis	2
❑ Vapor Power Systems	3
❑ Gas Power Systems	3
❑ Refrigeration and Heat Pump Systems	2
❑ Thermodynamic relations	2
❑ Combustion Fundamentals	2

Mode of Assessment

First exam:	**(20%)**
Second exam:	**(20%)**
Reports, H. works, and/or Projects	**(10%)**
Final exam:	**(50%)**

References

1. Thermodynamics, By: Holman
2. Thermodynamics, By: Cengel
3. Introduction to Thermodynamics, by: Sonntay
4. Basic Engineering Thermodynamics, By: Joel