CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MET301	MECHANICS OF MACHINERY	PCC	3	1	0	4

Preamble:

This course aims to introduce the students to the fundamentals of the kinematics of various mechanisms and also its analysis for its displacement, velocity, and acceleration. The course will also cover the design of cams, theory and analysis of gears, gear trains and synthesis of mechanisms. The static force analysis of planar mechanisms and concept of gyroscopic couple along with its effect has also been included. This course also aids students in estimating unbalance in rotating and reciprocating masses and suggesting methods to overcome it.

Prerequisite: Engineering Mechanics (EST 100)

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the fundamentals of kinematics, various planar mechanisms and interpret the basic principles of mechanisms and machines
CO 2	Perform analysis and synthesis of mechanisms
CO 3	Solve the problem on cams and gear drives, including selection depending on requirement.
CO 4	Calculate the gyroscopic effect in various situations
CO 5	Analyse rotating and reciprocating masses for its unbalance

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 12
CO 1	2										
CO 2	3	3	3	2	2						
CO 3	3	3	2	2	2						
CO 4	3	2	1	1	1						
CO 5	3	2	2	1	2						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1): Explain the fundamentals of kinematics, various planar mechanisms and their components

1. Define the terms Link, Kinematic chain, Mechanism & Machine.

2. Explain Grashof's law.

3 Apply Kutzbach criterion to find the mobility of mechanisms.

4.Sketch and explain the various inversions of slider crank chain/fourbar chain

Course Outcome 2 (CO2) : Perform analysis and synthesis of mechanisms

1. Find out the velocity and acceleration of links of various planar mechanisms

2. State and prove the Arnold Kennedy's three centre theorem

2. Derive an expression for the magnitude and direction of Coriolis component of acceleration

3. Design a four bar mechanism to generate a given function accurate upto 3 positions

4. Do the static force analysis of four bar/slider crank mechanisms with different loading conditions

Course Outcome 3 (CO3): Solve the problem on cams and gear drives, including selection depending on requirement

1. Why is a roller follower preferred over knife edge follower
2. Design a cam profile to suit the situations for the follower such as SHM, dwell, constant velocity, uniform acceleration cycloidal motion etc
3. What do you understand by the term “interference” as applied to gears
4. Find out the gear train values of simple ,compound and epicyclic gear trains

Course Outcome 4 (CO4): Calculate the gyroscopic effect in various situations

1. What do you understand by Gyroscopic couple? Derive its formula for its magnitude.
2. Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve.
3. Describe the working of a gyroscope.
4. How does gyroscopes help in guidance?

Course Outcome 5 (CO5): Analyse rotating and reciprocating masses for its unbalance

1. Distinguish between static balancing and dynamic balancing
2. Find out the magnitude and position of balancing masses required to balance unbalanced masses rotating in different planes.
3. What do you mean by primary and secondary unbalanced forces?
4. Find out the value of unbalanced primary force, primary couple, secondary force and secondary couple.

MODEL QUESTION PAPER

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B. TECH DEGREE EXAMINATION

Course Code: MET301

Course Name: MECHANICS OF MACHINERY

Max. Marks: 100 **Duration: 3 Hours**

PART – A

(ANSWER ALL QUESTIONS, EACH QUESTION CARRIES 3 MARKS)

1. Find out the degree of freedom in the following cases.

a) A planar link b) Two planar links joined by a revolute joint c) Three Planar links joined by three revolute joints

2. Describe the motion of the following items as pure rotation, pure translation or complex planar motion.
   a) The hand of a clock **b)** The pen in an XY plotter **c)** connecting rod of an IC engine
3. A rod of length 1m with its one end fixed at origin is oriented in the positive X direction. It rotates in the XY plane with an angular velocity of 10rad/s clockwise direction and angular acceleration of 10rad/s^2 in the counter clock wise direction at a particular instant. Find out the total acceleration experienced at the free end.
4. Obtain the expression for velocity when the cam follower motion is cycloidal in nature.
5. How do we bring interchangeability of gears?
6. What do you mean by type synthesis?
7. Define the term 'friction circle'
8. How does a gyroscope help in guidance of aircrafts?
9. Does a rotor which is statically balanced require dynamic balancing?
10. Why do we go for partial balancing in the case of balancing of reciprocating masses?

Part B

(ANSWER ONE FULL QUESTION FROM EACH MODULE)

MODULE – I

11. **a)** Draw the inversions of the mechanism shown in Figure 1 which leads to double crank,

double rocker and crank rocker mechanisms. Describe the nature of motion of each link in each case also **(9 marks)**

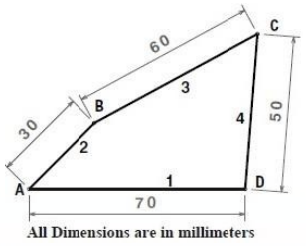

Figure-1

b) What are binary, ternary and quaternary links? **(5 marks)**

12. In the figure 2 given below the angular velocity of the crank OA is 600 r.p.m. Determine the linear velocity of the slider and angular velocity of all other links. The dimensions of various links are: OA=28 mm; AB = 44 mm; BC = 49 mm and BD = 46 mm. The centre distance between centres of rotation O and C is 65mm.The path of travel of slider is 11 mm below the fixed-point C **(14 marks)**

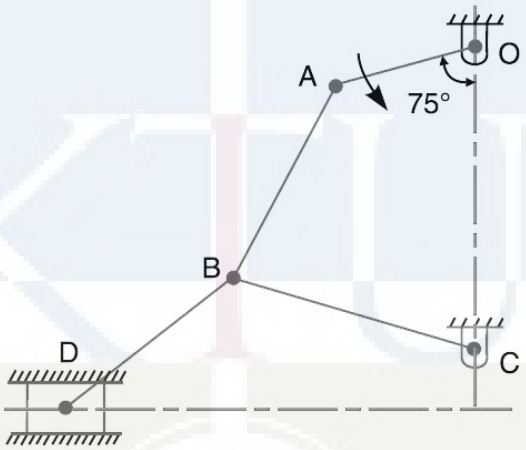

Figure-2

MODULE – II

13. a) What is meant by Coriolis component of acceleration. In which case does it occur? How is its direction determined? **(9 marks)**

b) A link OB rotating with a constant angular velocity of 2 rad/s in the counter clockwise direction and a block is sliding radially outwards on it with a uniform velocity of 0.75 m/s with respect to the rod as shown in the figure 3 below. Given OA =1 m and link OB is inclined to the positive X axis by 45°.Find out the absolute acceleration of block at A in magnitude and direction. **(5 marks)**

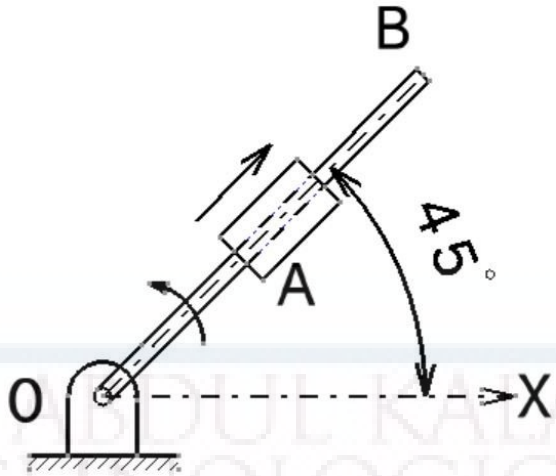

Figure-3

14. A cam rotating at 150 rpm operates a reciprocating follower of radius 2.5 cm. The follower axis is offset by 2.5 cm to the right. The least radius of the cam is 5 cm and the stroke of the follower is 5 cm. ascent and descent with take place by uniform acceleration and retardation. Ascent take place during 75° and descent during 90° of cam rotation. Dwell between ascent and descent is 60°. Draw the cam profile. Also sketch velocity and acceleration diagrams and mark salient values. **(14 marks)**

MODULE – III

15. In an epicyclic gear train as shown in Figure 4 the internal wheels A and B and the compound wheels C & D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G.E gears with A and C and F gears with B and D. All wheels have the same module and the number of teeth are:

$T_C = 28$, $T_D = 26$, $T_E = T_F = 18$

i) Sketch the arrangement

ii) Find the number of teeth on A and B

iii) If the arm G makes 100 r.p.m clockwise and A is fixed, find the speed B

iv) If the arm G makes 100 r.p.m clockwise and wheel A makes 10 r.p.m counter clockwise, find the speed of wheel B (**14 marks)**

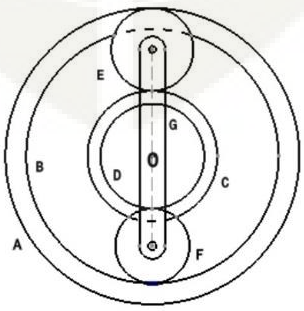

Figure-4

16. **a)** Design a four bar crank rocker to give 45° of rocker motion with a time ratio of 1:1.25 with 45° output rocker motion. **(9 marks)**

b) Design a slider crank mechanism to coordinate two positions of the input link and the slider for the following angular and linear displacement of the input link and slider respectively.

θ_{12} = 30° & S_{12}= 100 mm **(5 marks)**

MODULE – IV

17. The applied load on the piston of an offset slider-crank linkage shown in Fig. is 100 N, and the coefficient of friction between the slider and the guide is 0.27, using any method ,determine the magnitude and sense of torque T_2 applied on OA for the static equilibrium of the linkage. (**14 marks)**

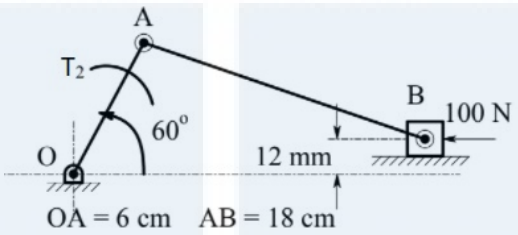

Figure-5

18 a) The wheels of a motor cycle have a moment of inertia of 5 kg m^2 and the engine parts, a moment of inertia of 0.35 kgm^2. The wheel axles and the crank shaft of the engine are all parallel to each other. If the ratio of reduction gears is 4:1, the wheel diameter is 700 mm, determine the magnitude and direction of the gyroscopic couple when the motor cycle negotiates a curve of 50 m radius at a speed of 50 km/hr. If the mass of the motor cycle with rider is 250 kg with centre of gravity at 65 cm above the ground in vertical position, determine the speed of the motor cycle rounding a curve of 60 m if the road condition permits an angle of heel of 45°. **(10 marks)**

b) Explain spin vector, precession vector, gyroscopic applied torque vector and gyroscopic reactive torque vector. **(4 marks)**

MODULE – V

19. A shaft carries four masses A, B, C and D which are placed in parallel planes perpendicular to the longitudinal axis. Th unbalanced masses at planes B and C are 3.6 kg and 2.6kg respectively and both are assumed to be concentrated at a radius of 25mm while the masses in planed A and D are both at a radius of 40mm.The angle between the planes B and C is 100° and that between B and A is 190°, both angles being measured in counter clock wise direction from the plane B .The planes containing A and B are 250mm apart and those containing B and C are 500mm.If the shaft is to be completely balanced ,determine

i) Masses at the planes A and D

ii) the distance between the planes C and D

iii) the angular position of the mass D **(14 marks)**

20. A five cylinder in-line engine running at 750 r.p.m. has successive cranks 144° apart, the distance between the cylinder centre lines being 375 mm. The piston stroke is 225mm and the ratio of the connecting rod to the crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the position of the central crank at which these maximum values occur. The reciprocating mass for each cylinder is 15 kg. **(14 marks)**

Syllabus

Module 1

Introduction to kinematics and mechanisms - various mechanisms, kinematic diagrams, degree of freedom- Grashof's criterion, inversions, coupler curves mechanical advantage, transmission angle. straight line mechanisms exact, approximate. Displacement, velocity analysis– relative motion - relative velocity. Instantaneous centre -Kennedy's theorem.

Module 2

Acceleration analysis- Relative acceleration - Coriolis acceleration - graphical and analytical methods.

Cams - classification of cam and followers - displacement diagrams, velocity and acceleration analysis of SHM, uniform velocity, uniform acceleration, cycloidal motion

Graphical cam profile synthesis, pressure angle.

Module 3

Gears – Classification- terminology of spur gears – law of gearing -tooth profiles- involute spur gears- contact ratio - interference - backlash - gear standardization – interchangeability. Gear trains - simple and compound gear trains - planetary gear trains.

Kinematic synthesis (planar mechanisms) - type, number and dimensional synthesis – precision points. Graphical synthesis for motion - path and prescribed timing - function generator. 2 position and 3 position synthesis – overlay Method. Freudenstein's equation.

Module 4

Static force analysis- Analysis of four bar linkages and slider crank mechanism, graphical method, Matrix method, principle of virtual work. Analysis of four bar and slider crank mechanisms with sliding and pin friction.

Gyroscopic couples-spin, precession and applied gyroscopic couple vectors-effects on the stability of two wheelers, four wheelers, sea vessels and air crafts, application of gyroscopes

Module 5

Static balancing-dynamic balancing-balancing of several masses in the same plane-several masses in different planes-graphical and analytical method-force and couple polygons.

Balancing of reciprocating masses -Single cylinder engine-multi cylinder engine -V-engine

Text Books

1. Ballaney P. L., Theory of Machines and Mechanisms, Khanna Publishers,2005

2 . S. S. Rattan, Theory of Machines, Tata Mc Graw Hill,2009

Reference Books

1. C. E. Wilson, P. Sadler, Kinematics and Dynamics of Machinery, Pearson Education,2005.
2. D.H. Myskza, Machines and Mechanisms Applied Kinematic Analysis, Pearson Education,2013
3. G. Erdman, G. N. Sandor, Mechanism Design: Analysis and synthesis Vol I & II, Prentice Hall of India,1984.
4. Ghosh, A. K. Malik, Theory of Mechanisms and Machines, Affiliated East West Press,1988
5. J. E. Shigley, J. J. Uicker, Theory of Machines and Mechanisms, McGraw Hill,2010
6. Norton, Kinematics and Dynamics of Machinery, Tata McGraw Hill,2009

Course Contents and Lecture Schedule

No 1	Topic Module-1-	No. of lectures 10 Hours
1.1	Introduction to kinematics and mechanisms	1 Hr
1.2	Various mechanisms	2 Hr
1.3	Kinematic diagrams, degree of freedom, Grashof's criterion	2 Hr
1.4	Inversions	1 Hr
1.5	Coupler curves mechanical advantage, transmission angle.	1 Hr
1.6	Straight line mechanisms exact, approximate	1 Hr
1.7	Displacement, velocity analysis, Kennedy's theorem.	2 Hr
2	**Module 2-**	**10 Hours**
2.1	Acceleration analysis- Relative acceleration - Coriolis acceleration -	1 Hr
2.2	Graphical and analytical methods. .	2Hr

2.3	Cams - classification of cam and followers	1 Hr
2.4	Displacement diagrams, velocity and acceleration analysis of SHM,	2 Hr
2.5	Uniform velocity,uniform acceleration and cycloidal motion	1 Hr
2.5	Graphical cam profile synthesis, pressure angle.	2 Hr
2.6	Analysis of tangent cam with roller follower and circular cam with flat follower	1 Hr
3	**Module-3**	**9 Hours**
3.1	Gears – terminology of spur gears – law of Gearing	1 Hr
3.2	involute spur gears - contact ratio- interference - backlash - gear standardization-interchangeability	1 Hr
3.3	Gear trains - simple and compound gear trains - planetary gear trains	2 Hr
3.4	Kinematic synthesis (planar mechanisms) - type, number and dimensional synthesis – precision points.	2 Hr
3.5	Graphical synthesis for motion - path and prescribed timing - function generator. 2 position and 3 position synthesis	2 Hr
3.6	Overlay Method. Freudenstein's equation	1 Hr
4	**Module-4-**	**8 Hours**
4.1	Static force analysis- Analysis of four bar linkages and slider crank mechanism	2 Hr
4.2	Graphical method, Matrix method	1 Hr
4.3	principle of virtual work	1 Hr
4.4	Analysis of four bar and slider crank mechanisms with sliding and pin friction.	1 Hr
4.4	Gyroscopic couples-spin, precession and applied gyroscopic couple vectors	2 Hr
4.5	Effects on the stability of two wheelers **,** Four wheelers, sea vessals and air crafts	1 Hr
5	**Module-5- Kinematics-synthesis**	**8 Hours**
5.1	Static balancing-dynamic balancing-	2 Hr

5.2	balancing of several masses in the same plane	1 Hr
5.3	several masses in different planes-graphical and analytical method	1 Hr
5.4	force and couple polygons	1 Hr
5.5	Balancing of reciprocating masses -Single cylinder engine	1 Hr
5.6	multi cylinder engine-v engine-inline engine	2 Hr

MRT303	LINEAR CONTROL SYSTEMS	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: This course enables students to systematically study the principles of system modelling, analysis and feedback control, and use them to design and evaluate feedback control systems.

Prerequisite: Linear Differential Equations, Laplace Transform

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand control systems in the design of dynamic systems.
CO 2	Identify a set of equations for representing and modelling physical systems.
CO 3	Perform analysis of control systems in time and frequency domains
CO 4	Analyse the stability of control systems.
CO 5	Identify different controllers and compensation techniques
CO 6	Apply the knowledge of control systems in real time control applications

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2		2								
CO 2	3	2	2	2								2
CO 3	3	3										
CO 4	3	3	2	2								2
CO 5	3	2										2
CO 6	3	2		2								2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	10	10	30
Analyse	10	10	40
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Differentiate between open loop and closed loop control systems with examples.

2. What do you mean by transfer function of a system?

3. What is Mason's Gain Formula?

Course Outcome 2 (CO2)

1. Obtain the value of current in an RC circuit excited with a constant voltage source.

2. Obtain the transfer function of an armature controlled DC motor.

3. What do you mean by analogous systems?

Course Outcome 3(CO3):

1. What are the standard test signals?

2. Obtain the step response of a second order system.

3. Obtain the polar plot of the system $\frac{10(s+1)}{(s+2)(s+5)}$.

Course Outcome 4 (CO4):

1. Determine the RH stability of given characteristic equation, $s^4+8s^3+18s^2+16s+5=0$.

2. Determine the limiting value of 'K' for stability $G(s)H(s) = \frac{K(s+4)}{s(s-2)}$

3. Sketch the root locus of the unity feedback system with $G(s) = \frac{K}{s^2+2s+2}$ for positive values of K.

Course Outcome 5 (CO5):

1. What is a Phase Lag compensator and why is it used?

2. What is the need of PID controller?

3. Describe the design procedure for a lag compensator.

Course Outcome 6 (CO6):

1. Describe the role of control system in mechatronics.

2. Illustrate an Automatic temperature control system suitable for automation.

3. Describe the working of an automatic traffic light control system.

Model Question paper

Course Code: MRT303

Course Name: LINEAR CONTROL SYSTEMS

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. What is the difference between type and order of a system?
2. What do you mean by transfer function?
3. A unity feedback system has an open loop transfer function $\frac{20(S+5)}{S^2(S+0.1)(S+3)}$. Determine steady state error for unit parabolic input?
4. Explain the effect of adding poles and zeros on root locus?
5. Derive an expression for resonant frequency and resonant peak of a second order system.
6. Determine the phase cross over frequency of a system with open loop transfer function $G(s) = \frac{1}{(1+2s)(1+s)}$.
7. Give two examples of non-minimum phase transfer function. Explain why they are called non-minimum phase system?
8. Give a physical example of transportation lag. How can it be represented?
9. What is the need for cascade compensation?
10. With an example explain the role of control systems in Mechatronics.

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Differentiate between open loop control system & closed loop control system. (6)

    (b) Obtain the transfer function of a series RLC circuit. (8)

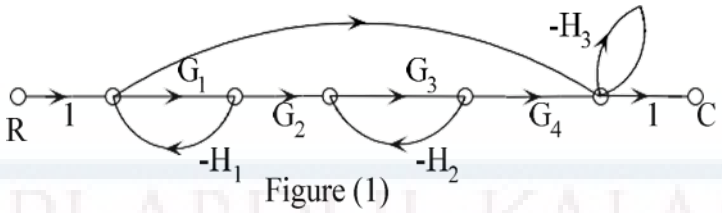

Figure (1)

12. (a) Find the overall transfer function of the signal flow graph shown in Figure (1) using Mason's gain formula (7)

    (b) Obtain the value of current in an RC circuit excited with a constant voltage source(7)

Module 2

13. (a)Obtain the force voltage analogy of a general mechanical translation system (4)

    (b) Obtain the transfer function of a field controlled DC Motor (8)

14. (a) Obtain the transfer function of an armature controlled DC Motor. (10)

    (b) Explain the force-current analogy. (4)

Module 3

15. (a) The forward path transfer function of a unity feedback control system is given by $G(s) = \frac{2}{s(s+3)}$. Obtain an expression for unit step response of the system.(10)

    (b) What do you mean by PID control? (4)

16. (a) Evaluate the static error coefficients and steady state error for a unity feedback system having a forward path transfer function$G(s) = \frac{50}{s(s+10)}$for the input $r(t) = 1 + 2t + t^2$. (10)

    (b) What are the standard test signals? (4)

Module 4

17. The open loop transfer function of a unity feedback system is $\frac{10K}{s(s^2+2s+2)}$. Find the open loop poles.Draw the root locus. Find the range of values of K for which the system is stable. Find all the closed loop poles corresponding to a damping ratio of 0.7. (14)

18. (a) Ascertain stability of the system whose characteristic equation is

    $s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$. (5)

    (b) The open loop transfer function of a unity feedback system is $\frac{10}{s(s+2)(s+5)}$. Draw the Bode plot and find Gain margin and phase margin (9)

Module 5

19. Illustrate an Automatic temperature control system suitable for automation. (14)
20. Describe the working of an automatic traffic light control system. (14)

Syllabus

Module 1 (10 Hours)

Introduction: Principle of Automatic control- Open loop and closed loop systems – examples System modelling & approximations -modelling of electrical systems – dynamic equations using KCL & KVL of RL, RC and RLC circuits – Transfer functions- development of block diagrams of simple electrical networks - block diagram reduction -signal flow graphs - Mason's gain formula.

Module 2 (9 Hours)

Modelling and analogy of other physical systems: Modelling of translational and rotational mechanical systems –differential equations for mass, spring, and dashpot elements -D'Alembert's principle – dynamic equations & transfer function for typical mechanical systems - analogous systems –force voltage & force-current analogy - toque-voltage & torque-current analogy – electromechanical systems - transfer function of armature controlled dc motor & field controlled dc motor

Module 3 (9 Hours)

Time domain analysis: Continuous systems -standard test signals - step, ramp, parabolic, impulse - transient and steady state response –first order systems - unit impulse, step responses of first order systems and second order systems - under damped and over damped systems - time domain specifications - steady state error – static position, velocity & acceleration error constants. Control structures: PID control, feed forward, ratio control and predictive control.

Module 4 (9 Hours)

Stability of control systems and Frequency Domain Analysis: Concept of stability - stability & location of the poles in S-plane - Routh-Hurwitz stability criterion-Root Locus Method, Construction of root locus- Effect of poles and zeros and their location on the root locus. Frequency Response representation- Polar Plot- Logarithmic Plots-Frequency Domain Specifications - Non-Minimum Phase Systems

Module 5 (8 Hours)

Compensation techniques and Case studies in Mechatronics: Need for Cascade compensation-Cascade Compensation- PI, PD and PID controllers – tuning of PID Controller- Lead, Lag and Lead- Lag compensation- Role of control system in mechatronics-case studies Automatic temperature control, automatic traffic light control-Automatic street light control

Text Books

1. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International Pvt Ltd, 6/e.

2. Katsuhiko Ogata, “Modern Control Engineering”, Pearson Education India, 5/e.

3. A. Nagoorkani, “Control Systems”, RBA Publications.

Reference Books

1.Kuo, “Automatic Control Systems”, Prentice Hall.

2. Norman S. Nise, “Control Systems Engineering”, Wiley India Pvt. Ltd.

3. K. Ogata, “Discrete- Time Control Systems”, Pearson Education .

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	
1.1	Principle of Automatic control- Open loop and closed loop systems – examples System modelling & approximations	2 Hours
1.2	Modelling of electrical systems – dynamic equations using KCL & KVL of RL, RC and RLC circuits	4 Hours
1.3	Transfer functions- development of block diagrams of simple electrical networks - block diagram reduction -signal flow graphs - Mason's gain formula	4 Hours
2	**Modelling and analogy of other physical systems**	
2.1	Modelling of translational and rotational mechanical systems – differential equations for mass, spring, and dashpot elements - D'Alembert’s principle – dynamic equations & transfer function for typical mechanical systems	3 Hours
2.2	Analogous systems –force voltage & force-current analogy - toque-voltage & torque-current analogy	3 Hours
2.3	Electromechanical systems - transfer function of armature controlled dc motor & field controlled dc motor	3 Hours
3	**Time domain analysis**	
3.1	Continuous systems -standard test signals - step, ramp, parabolic, impulse.	2 Hours
3.2	Transient and steady state response –first order systems - unit impulse, step responses of first order systems and second order systems	3 Hours
3.3	Under damped and over damped systems - time domain specifications - steady state error – static position, velocity & acceleration error constants	2 Hours
3.4	Control structures: PID control, feed forward, ratio control and predictive control	2 Hours
4	**Stability of control systems and Frequency Domain Analysis**	
4.1	Concept of stability - stability & location of the poles in S-plane -	2 Hours

	Routh-Hurwitz stability criterion	
4.2	Root Locus Method, Construction of root locus- Effect of poles and zeros and their location on the root locus.	4 Hours
4.3	Frequency Response representation- Polar Plot- Logarithmic Plots- Frequency Domain Specifications - Non-Minimum Phase Systems	3 Hours
5	**Compensation techniques and Case studies in Mechatronics**	
5.1	Need for Cascade compensation-Cascade Compensation- PI, PD and PID controllers	2 Hours
5.2	Tuning of PID Controller- Lead, Lag and Lead- Lag compensation-	3 Hours
5.3	Role of control system in mechatronics-case studies Automatic temperature control, automatic traffic light control-Automatic street light control	3 Hours

MRT305	PLC & DATA ACQUISITION SYSTEMS	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: In simple terms PLC is a solid-state industrial control device which receives signals from user supplied controlled devices, such as sensors and switches, implements them in a precise pattern determined by ladder-diagram based application progress stored in user memory, and provides outputs for control of processes or user supplied devices, such as relays or motor starters. Industry needs less manpower, more and accurate throughput. Accuracy enhances by exact reading of data from sources which further uses to control the whole system.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Study the evolution and advantages of PLC.
CO 2	Understand the various PLC instructions.
CO 3	Design specific applications using PLC
CO 4	Understand the need of computer control in automation.
CO 5	Study data acquisition systems.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	2	-	-	2	-	-	-	3	-	3
CO 2	3	3	2	-	-	2	-	-	-	3	-	3
CO 3	3	3	3	3	3	2	-	-	3	3	-	3
CO 4	3	2	2	-	3	2	-	-	3	3	-	3
CO 5	3	2	2	-	-	2	-	-	-	3	-	3

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. State the functionality of Programmable Logic Controllers.

2. List the different configurations used.

3. Define the different capabilities & advantages of PLCs.

Course Outcome 2 (CO2)

1. Demonstrate the different programs using PLCs

2. Give example for real time programming using PLCs

3. Describe the functionality of the different instructions.

Course Outcome 3(CO3):

1. Demonstrate different applications of PLC.

2. Give example for different control using PLC

3. Describe the functionality of automation.

Course Outcome 4 (CO4):

1. State the functionality of the data acquisition system.

2. List the functionality of a digital control interfacing.

3. Define the functionality of SCADA systems.

Course Outcome 5 (CO5):

1. State the signal conversions.

2. List the Practical implementation of sampling and digitizing.

3. Develop the ADC and DAC interfacing with microprocessors.

Model Question Paper

Course Code: MRT305

Course Name: PLC & DATA ACQUISITION SYSTEMS

Max.Marks:100 **Duration: 3 Hours**

PARTA

Answer all Questions. Each question carries 3 Marks

1. Explain opto isolator in PLC input output module
2. Explain ladder logic in PLC
3. What are various arithmetic functions used in PLC?
4. Explain the functions of retentive timer
5. Brief out the data handling functions in PLC
6. List out any three program control instructions in PLC
7. Explain the need of computer in control system
8. Explain data logger in computer control
9. The analog input signal ranges from -5v to +5v for a 9 bit ADC
   (a) How many step intervals are available within an ADC
   (b) What is the resolution in volt/increment
10. Explain the term aliasing

PART B

Answer any one full question from each module. Each question carries 14 Marks

Module 1

11. (a) Explain the architecture of a PLC system with neat diagrams

    (b)Define PLC and explain how it is helpful in automated process.

12. a)Draw a ladder diagram for liquid level controller

    (b) State and explain advantages and disadvantages of PLC in detail.

Module 2

13. Develop a PLC adder diagram from the following sequence . Start the motor with push switch, and then after delay of 90 sec , start the pump. When the motor is switched off, the pump will get switched off after a delay of 5 sec. Mention the logic used for each rung in the program to substantiate the answer

14. Timers and counters in the PLC with suitable example

Module 3

15. Design a ladder logic for the bottle filling systems for the following sequence
    i. Start the program by processing the start push button
    ii. Once the start push button is pressed the conveyor belt should be start moving.
    iii. If the proximity sensor senses the bottle in the conveyor belt. The belts have to stop moving.
16. Enumerate data transfer and program control instruction used in PLC

Module 4

17. (a) Draw and explain SCADA architecture in detail.

    (b) State applications of SCADA.

18. (a) Explain advantages and disadvantages of SCADA systems.

    (b) Explain first, second and third generations of SCADA architecture.

Module 5

19. Discuss in detail about analog to digital conversion procedure
20. How a DAC is interfaced to microprocessor.Explain the procedure with necessary block diagram

Syllabus

Module 1. BASICS OF PLC (9hrs)

Definition and History of PLC-PLC advantage and disadvantages- Over all PLC systems-CPU and Programmer/Monitors-PLC input and output models – Architecture- PLC Programming language – Relay logic – Ladder logic – Programming of Gates – Flow charting as a programming method – connecting PLC to computer - PLC Troubleshooting and Maintenance.

Module 2. PLC PROGRAMMING (9hrs)

Programming of Timers – Introduction - ON delay, OFF delay, Retentive Timers – PLC Timer functions – Examples of timer function Industrial application. Programming Counters –up/down counter – Combining counter - Examples of counter function Industrial application. PLC Arithmetic Functions – PLC number Comparison function

Module 3. PLC DATA HANDLING FUNCTIONS (9hrs)

PLC Program Control Instructions: Master Control Reset - Skip – Jump and Move Instruction. Sequencer instructions - Types of PLC Analog modules and systems, PLC analog signal processing – BCD or multi bit data processing – Case study of Tank level control system, bottle filling system and Sequential switching of motors

Module 4. COMPUTER CONTROL – INTRODUCTION (9hrs)

Need of computer in a control system-Functional block diagram of a computer control system-Data loggers- Supervisory computer control- Direct digital control-Digital control interfacing-SCADA.

Module 5. DATA ACQUISITION SYSTEMS (9hrs)

Sampling theorem – Sampling and digitizing – Aliasing – Sample and hold circuit – Practical implementation of sampling and digitizing – Definition, design and need for data acquisition systems – Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation – Microprocessor/PC based acquisition systems.

TEXT BOOKS:

[1] Petrezeulla, "Programmable Logic Controllers", McGraw Hill, 1989.

[2] Curtis D. Johnson," Process Control Instrumentation Technology", 8th edition Prentice Hall June 2005

[3] D.Roy Choudhury and Shail B.Jain, " Linear Integrated Circuits", New age International Pvt. Ltd,

REFERENCES:

[1] Hughes .T, "Programmable Logic Controllers", ISA Press, 1989.

[2] G.B.Clayton," Data Converters", The Mac Millian Press Ltd., 1982.

[3] John w.Webb & Ronald A.Reis., "Programmable logic controllers- principles and applications", 5th Edition – PHI Learning Pvt. LTd, New Delhi -2010.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Basics of PLC**	
1.1	Definition and History of PLC	1
1.2	PLC advantage and disadvantages	1
1.3	Over all PLC systems-CPU and Programmer/Monitors-PLC input and output models	1
1.4	Architecture	1
1.5	PLC Programming language	1
1.6	Relay logic – Ladder logic – Programming of Gates	1
1.7	Flow charting as a programming method	1
1.8	connecting PLC to computer	1
1.9	PLC Troubleshooting and Maintenance.	1
2	**PLC Programming**	
2.1	Programming of Timers – Introduction - ON delay, OFF delay	1
2.2	Retentive Timers	1
2.3	PLC Timer functions	1
2.4	Examples of timer function Industrial application.	1
2.5	Programming Counters –up/down counter	1

2.6	Combining counter	1
2.7	Examples of counter function Industrial application.	1
2.8	PLC Arithmetic Functions	1
2.9	PLC number Comparison function	1
3	**PLC Data Handling Functions**	
3.1	PLC Program Control Instructions: Master Control Reset	2
3.2	Skip – Jump and Move Instruction	1
3.3	Sequencer instructions -	1
3.4	Types of PLC Analog modules and systems	1
3.5	PLC analog signal processing	1
3.6	BCD or multi bit data processing	1
3.7	Case study of Tank level control system, bottle filling system and Sequential switching of motors	2
4	**Computer Control – Introduction**	
4.1	Need of computer in a control system	1
4.2	Functional block diagram of a computer control system-	1
4.3	Data loggers-	2
4.4	Supervisory computer control	1
4.5	Direct digital control	1
4.6	Digital control interfacing.	2
4.7	SCADA	2
5	**Data Acquisition Systems**	
5.1	Sampling theorem – Sampling and digitizing	2
5.2	Aliasing – Sample and hold circuit.	1
5.3	Practical implementation of sampling and digitizing –	1
5.4	Definition, design and need for data acquisition systems –	1
5.5	Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation –	2
5.6	Microprocessor/PC based acquisition systems	2

MRT307	SOFT COMPUTING TECHNIQUES	CATEGORY	L	T	P	CREDIT
		PCC	3	1	0	4

Preamble: This course aims the students to learn about the introduction of all basics soft computing and basic concept of geneticalgorithms

Prerequisite: EST-102PROGRAMMING IN C

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the basic concept of Fuzzy set theory
CO 2	Be familiar with concepts of fuzzy inference model
CO 3	Understand the basic concepts of geneticalgorithms and simulated annealing
CO 4	Understand basic concept of Competitive Learning Networks
CO 5	Understand the basic concept of Adaptive Networks and various application of soft computing

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-
CO4	3	-	3	3	-	-	-	-	-	-	-	-
CO5	3	-	2	-	3	-	3	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			

Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What do you mean by FIS?
2. What is the advantage of fuzzy systems over conventional methods?
3. How do you customize a membership function?

Course Outcome 2 (CO2)

1. What is a fuzzy inference model?
2. Explain about Mamdani Fuzzy Model.
3. Write a note on Sugeno Fuzzy Model.

Course Outcome 3(CO3):

1. What do you mean by Simulated Annealing?
2. Explain concept of genetic algorithm.
3. Explain Random Search.

Course Outcome 4 (CO4):

1. Discuss about Neural networks as solution provider.

2. Explain about RBF.

3. Briefly explain about Supervised Learning.

Course Outcome 5 (CO5):

1. Explain the steps in Hybrid Learning Algorithm.
2. Give an application of adaptive networks?
3. Explain how adaptive networks function.

Model Question paper

Course code: MRT307

Max. Marks: 100 **Duration: 3 Hours**

SOFT COMPUTING TECHNIQUES (2019- Scheme)

PART A

(Answer all the questions, each question carries 3 marks)

1 .Define Soft Computing and list out its constituents.

2. Explain fuzzy set theory with example.

3. Illustrate with diagram the working of fuzzy inference system.

4. Explain Mamdani model with neat diagram.

5. Draw the diagram which represents various units of perceptron network?

6. Differentiate between supervised and unsupervised learning?

7. Write applications for adaptive systems?

8. Draw a flow diagram which depicts ANFIS procedure?

9. Write a short note on character recognition using neural network?

10. What is the difference between forward and inverse kinematics problem?

PART B

(Answer one full question from each module .each question carries 14 marks)

Module 1

11. (a) Write a note on characteristics of Soft computing. (10 marks)

(b) Explain the term: a) Fuzzy number b) open-right. (4 marks)

12. (a) Explain the set theoretic operations . (10 marks)

(b) Analyse the importance of neural networking. (4 marks)

Module 2

13. (a) Explain the mamdani fuzzy model with example. (10 marks)

(b) Define the term inference model. (4 marks)

14. Explain the sugeno model and tsukamoto model . (14 marks)

Module 3

15. (a) Explain concept of genetic algorithm. . (10 marks)

(b) Define the term perceptron's. (4 marks)

16. Narrate the steps for supervised Learning neural networks. (14 marks)

Module 4

17. Explain radial basis function networks. (14 marks)

18. (a)Explain the kohonen self-learning networks. (10 marks)

(b) Explain the basic concept of Hebbian learning. (4 marks)

Module 5

19. Explain with the term Hybrid learning algorithms. (14 marks)

20. Explain in detail about ANFIS and RBFN. (14 marks)

Syllabus

SOFT COMPUTING TECHNIQUES

Module 1 (9 Hours)

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning –Extension Principle and Fuzzy Relations

Module 2 (9 Hours)

Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models. Derivative-based Optimization

Module 3 (9 Hours)

Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search. Supervised Learning Neural Networks – Perceptrons - Adaline – Back propagation Mutilayer Perceptrons

Module 4 (9 Hours)

Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization –Hebbian learning.

Module 5 (9 Hours)

Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross- fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling— Printed Character Recognition – Inverse Kinematics Problems– Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction

Text Books

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. S.N.Sivanandam&S.N.Deepa "Principles of Soft Computing" Wiley India Pvt. Ltd., 2007

Reference Books

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
3. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
4. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to Neuro**	
1.1	Fuzzy and Soft Computing	1 Hour
1.2	Fuzzy Sets ,Basic Definition and Terminology	1 Hour
1.3	Set-theoretic Operations	1 Hour
1.4	Member Function Formulation and Parameterization	2 Hours
1.5	Fuzzy Rules and Fuzzy Reasoning	2 Hours
1.6	Extension Principle and Fuzzy Relations	2 Hours
2	**Fuzzy Inference Systems**	
2.1	Mamdani Fuzzy Models	2 Hours
2.2	Sugeno Fuzzy Models	2 Hours
2.3	Tsukamoto Fuzzy Models	2 Hours

2.4	Derivative-based Optimization	3 Hours
3	**Genetic Algorithms**	
3.1	Genetic Algorithms	1 Hour
3.2	Simulated Annealing	1 Hour
3.3	Random Search ,Downhill Simplex Search	2 Hours
3.4	Learning Neural Networks , Perceptrons	2 Hours
3.5	Adaline	1 Hour
3.6	Back propagation MutilayerPerceptrons	2 Hours
4	**Radial Basis Function Network**	
4.1	Unsupervised Learning Neural Networks	2 Hours
4.2	Competitive Learning Networks	2 Hours
4.3	Kohonen Self-Organizing Networks	1 Hour
4.4	Learning Vector Quantization	2 Hours
4.5	Hebbian learning	2 Hours
5	**Adaptive Neuro-Fuzzy Inference Systems**	
5.1	Architecture	1 Hour
5.2	Hybrid Learning Algorithm ,Learning Methods	1 Hour
5.3	fertilize ANFIS and RBFN	2 Hours
5.4	Coactive Neuro Fuzzy Modeling	1 Hour
5.5	Printed Character Recognition – Inverse Kinematics Problems	1 Hour
5.6	Automobile Fuel Efficiency Prediction	1 Hour
5.7	Soft Computing for Color Recipe Prediction	2 Hours

HUT 300	Industrial Economics & Foreign Trade	Category	L	T	P	CREDIT
		HSMC	3	0	0	3

Preamble: To equip the students to take industrial decisions and to create awareness of economic environment.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	Explain the problem of scarcity of resources and consumer behaviour, and to evaluate the impact of government policies on the general economic welfare. (Cognitive knowledge level: **Understand**)
CO2	Take appropriate decisions regarding volume of output and to evaluate the social cost of production. (Cognitive knowledge level: **Apply**)
CO3	Determine the functional requirement of a firm under various competitive conditions. (Cognitive knowledge level: **Analyse**)
CO4	Examine the overall performance of the economy, and the regulation of economic fluctuations and its impact on various sections in the society. (Cognitive knowledge level: **Analyse**)
CO5	Determine the impact of changes in global economic policies on the business opportunities of a firm. (Cognitive knowledge level: **Analyse**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2										3	
CO2	2	2			2	2	3				3	
CO3	2	2	1								3	
CO4	2	2	1			1					3	
CO5	2	2	1								3	

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination Marks**
	Test 1 (Marks)	**Test 2 (Marks)**	
Remember	**15**	**15**	**30**
Understand	**20**	**20**	**40**
Apply	**15**	**15**	**30**

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
150	**50**	**100**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment - Test (2 numbers)	: 25 marks
Continuous Assessment - Assignment	: 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B.

Part A	: 30 marks
Part B	: 70 marks

Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 3 sub-divisions and carries 14 marks.

SYLLABUS

HUT 300 Industrial Economics & Foreign Trade

Module 1 (Basic Concepts and Demand and Supply Analysis)

Scarcity and choice - Basic economic problems- PPC – Firms and its objectives – types of firms – Utility – Law of diminishing marginal utility – Demand and its determinants – law of demand – elasticity of demand – measurement of elasticity and its applications – Supply, law of supply and determinants of supply – Equilibrium – Changes in demand and supply and its effects – Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.

Module 2 (Production and cost)

Production function – law of variable proportion – economies of scale – internal and external economies – Isoquants, isocost line and producer's equilibrium – Expansion path – Technical progress and its implications – Cobb-Douglas production function - Cost concepts – Social cost: private cost and external cost – Explicit and implicit cost – sunk cost - Short run cost curves - long run cost curves – Revenue (concepts) – Shutdown point – Break-even point.

Module 3 (Market Structure)

Perfect and imperfect competition – monopoly, regulation of monopoly, monopolistic completion (features and equilibrium of a firm) – oligopoly – Kinked demand curve – Collusive oligopoly (meaning) – Non-price competition – Product pricing – Cost plus pricing – Target return pricing – Penetration pricing – Predatory pricing – Going rate pricing – Price skimming.

Module 4 (Macroeconomic concepts)

Circular flow of economic activities – Stock and flow – Final goods and intermediate goods - Gross Domestic Product - National Income – Three sectors of an economy- Methods of measuring national income – Inflation- causes and effects – Measures to control inflation- Monetary and fiscal policies – Business financing- Bonds and shares -Money market and Capital market – Stock market – Demat account and Trading account - SENSEX and NIFTY.

Module 5 (International Trade)

Advantages and disadvantages of international trade - Absolute and Comparative advantage theory - Heckscher - Ohlin theory - Balance of payments – Components – Balance of Payments

deficit and devaluation – Trade policy – Free trade versus protection – Tariff and non-tariff barriers.

Reference Materials

1. Gregory N Mankiw, 'Principles of Micro Economics', Cengage Publications
2. Gregory N Mankiw, 'Principles of Macro Economics', Cengage Publications
3. Dwivedi D N, 'Macro Economics', Tata McGraw Hill, New Delhi.
4. Mithani D M, 'Managerial Economics', Himalaya Publishing House, Mumbai.
5. Francis Cherunilam, 'International Economics', McGraw Hill, New Delhi.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Why does the problem of choice arise?
2. What are the central problems?
3. How do we solve the basic economic problems?
4. What is the relation between price and demand?
5. Explain deadweight loss due to the imposition of a tax.

Course Outcome 2 (CO2):

1. What is shutdown point?
2. What do you mean by producer equilibrium?
3. Explain break-even point;
4. Suppose a chemical factory is functioning in a residential area. What are the external costs?

Course Outcome 3 (CO3):

1. Explain the equilibrium of a firm under monopolistic competition.
2. Why is a monopolist called price maker?
3. What are the methods of non-price competition under oligopoly?

4. What is collusive oligopoly?

Course Outcome 4 (CO4):

1. What is the significance of national income estimation?
2. How is GDP estimated?
3. What are the measures to control inflation?
4. How does inflation affect fixed income group and wage earners?

Course Outcome 5 (CO5):

1. What is devaluation?
2. Suppose a foreign country imposes a tariff on Indian goods. How does it affect India's exports?
3. What is free trade?
4. What are the arguments in favour of protection?

Model Question paper

QP CODE: **PAGES:3**

Reg No:_____ **Name :_____**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIFTH /SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 300

Course Name: Industrial Economics & Foreign Trade

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Why does an economic problem arise?

2. What should be the percentage change in price of a product if the sale is to be increased by 50 percent and its price elasticity of demand is 2?

3. In the production function Q= $2L^{1/2}K^{1/2}$ if L=36 how many units of capital are needed to produce 60 units of output?

4. Suppose in the short run AVC 4. Suppose in the short run AVC<P<AC. Will this firm produce or shut down? Give reason.

5. What is predatory pricing?

6. What do you mean by non- price competition under oligopoly?

7. What are the important economic activities under primary sector?

8. Distinguish between a bond and share?

9. What are the major components of balance of payments?

10. What is devaluation? **(10 x 3 = 30 marks)**

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Prepare a utility schedule showing units of consumption, total utility and marginal utility, and explain the law of diminishing marginal utility. Point out any three limitations of the law.

    b) How is elasticity of demand measured according to the percentage method? How is the measurement of elasticity of demand useful for the government?

Or

12. a) Explain the concepts consumer surplus and producer surplus.

    b) Suppose the government imposes a tax on a commodity where the tax burden met by the consumers. Draw a diagram and explain dead weight loss. Mark consumer surplus, producer surplus, tax revenue and dead weight loss in the diagram.

MODULE II

13. a) What are the advantages of large-scale production?

    b) Explain Producer equilibrium with the help of isoquants and isocost line. What is expansion path?

Or

14. a) Explain break-even analysis with the help of a diagram.

    b) Suppose the monthly fixed cost of a firm is Rs. 40000 and its monthly total variable cost is Rs. 60000.

    i. If the monthly sales is Rs. 120000 estimate contribution and break-even sales.
    ii. If the firm wants to get a monthly profit of Rs.40000, what should be the sales?

    c) The total cost function of a firm is given as $TC=100+50Q - 11Q^2+Q^3$. Find marginal cost when output equals 5 units.

MODULE III

15. a) What are the features of monopolistic competition?

b) Explain the equilibrium of a firm earning supernormal profit under monopolistic competition.

Or

16. a) Make comparison between perfect competition and monopoly.

b) Explain price rigidity under oligopoly with the help of a kinked demand curve.

MODULE IV

17. a) How is national income estimated under product method and expenditure method?

b) Estimate GDPmp, GNPmp and National income

Private consumption expenditure	= 2000 (in 000 cores)
Government Consumption	= 500
NFIA	= -(300)
Investment	= 800
Net=exports	=700
Depreciation	= 400
Net-indirect tax	= 300

Or

18. a) What are the monetary and fiscal policy measures to control inflation?

b) What is SENSEX?

MODULE V

19. a) What are the advantages of disadvantages of foreign trade?

b) Explain the comparative cost advantage.

Or

20. a) What are the arguments in favour protection?

b) Examine the tariff and non-tariff barriers to international trade.

(5 × 14 = 70 marks)

Teaching Plan

Module 1 (Basic concepts and Demand and Supply Analysis)		**7 Hours**
1.1	Scarcity and choice – Basic economic problems - PPC	1 Hour
1.2	Firms and its objectives – types of firms	1 Hour
1.3	Utility – Law of diminishing marginal utility – Demand – law of demand	1 Hour
1.4	Measurement of elasticity and its applications	1 Hour
1.5	Supply, law of supply and determinants of supply	1 Hour
1.6	Equilibrium – changes in demand and supply and its effects	1 Hour
1.7	Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.	1 Hour
Module 2 (Production and cost)		**7 Hours**
2.1	Productions function – law of variable proportion	1 Hour
2.2	Economies of scale – internal and external economies	1 Hour
2.3	producers equilibrium – Expansion path	1 Hour
2.4	Technical progress and its implications – cob Douglas Production function	1 Hour
2.5	Cost concepts – social cost: private cost and external cost – Explicit and implicit cost – sunk cost	1 Hour
2.6	Short run cost curves & Long run cost curves	1 Hour
2.7	Revenue (concepts) – shutdown point – Break-even point.	1 Hour
Module 3 (Market Structure)		**6 hours**
3.1	Equilibrium of a firm, MC – MR approach and TC – TR approach	1 Hour
3.2	Perfect competition & Imperfect competition	1 Hour
3.3	Monopoly – Regulation of monopoly – Monopolistic competition	1 Hour
3.4	Oligopoly – kinked demand curve	1 Hour
3.5	Collusive oligopoly (meaning) – Non price competition	1 Hour
3.6	Cost plus pricing – Target return pricing – Penetration, Predatory pricing – Going rate pricing – price skimming	1 Hour

Module 4 (Macroeconomic concepts)		7 Hours
4.1	Circular flow of economic activities	1 Hour
4.2	Stock and flow – Final goods and intermediate goods – Gross Domestic Product - National income – Three sectors of an economy	1 Hour
4.3	Methods of measuring national income	1 Hour
4.4	Inflation – Demand pull and cost push – Causes and effects	1 Hour
4.5	Measures to control inflation – Monetary and fiscal policies	1 Hour
4.6	Business financing – Bonds and shares – Money market and capital market	1 Hour
4.7	Stock market – Demat account and Trading account – SENSEX and NIFTY	1 Hour
Module 5 (International Trade)		**8 Hours**
5.1	Advantages and disadvantages of international trade	1 Hour
5.2	Absolute and comparative advantage theory	2 Hour
5.3	Heckscher – Ohlin theory	1 Hour
5.4	Balance of payments - components	1 Hour
5.5	Balance of payments deficit and devaluation	1 Hour
5.6	Trade policy – Free trade versus protection	1 Hour
5.7	Tariff and non tariff barriers.	1 Hour

HUT 310	Management for Engineers	Category	L	T	P	Credit
		HMC	3	0	0	3

Preamble: This course is intended to help the students to learn the basic concepts and functions of management and its role in the performance of an organization and to understand various decision-making approaches available for managers to achieve excellence. Learners shall have a broad view of different functional areas of management like operations, human resource, finance and marketing.

Prerequisite: Nil

Course Outcomes After the completion of the course the student will be able to

CO1	Explain the characteristics of management in the contemporary context (Cognitive Knowledge level: **Understand**).
CO2	Describe the functions of management (Cognitive Knowledge level: **Understand**).
CO3	Demonstrate ability in decision making process and productivity analysis (Cognitive Knowledge level: **Understand**).
CO4	Illustrate project management technique and develop a project schedule (Cognitive Knowledge level: **Apply**).
CO5	Summarize the functional areas of management (Cognitive Knowledge level: **Understand**).
CO6	Comprehend the concept of entrepreneurship and create business plans (Cognitive Knowledge level: **Understand**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**				**1**	**2**	**2**	**2**		**2**	**1**	**1**
CO2	**2**				**1**	**1**		**2**	**1**	**2**	**1**	**1**
CO3	**2**	**2**	**2**	**2**	**1**							
CO4	**2**	**2**	**2**	**2**	**1**						**2**	**1**
CO5	**2**					**1**	**1**		**1**	**2**	**1**	
CO6		**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Abstract POs defined by National Board of Accreditation			
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	**Test 1 (Marks in percentage)**	**Test 2 (Marks in percentage)**	**End Semester Examination (Marks in percentage)**
Remember	15	15	30
Understand	15	15	30
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 Hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment - Test : 25 marks

Continuous Assessment - Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

HUT 310 Management for Engineers (35 hrs)

Module 1 (Introduction to management Theory- 7 Hours)

Introduction to management theory, Management Defined, Characteristic of Management, Management as an art-profession, System approaches to Management, Task and Responsibilities of a professional Manager, Levels of Manager and Skill required.

Module 2 (management and organization- 5 hours)

Management Process, Planning types , Mission, Goals, Strategy, Programmes, Procedures, Organising, Principles of Organisation, Delegation, Span of Control, Organisation Structures, Directing, Leadership, Motivation, Controlling..

Module 3 (productivity and decision making- 7 hours)

Concept of productivity and its measurement; Competitiveness; Decision making process; decision making under certainty, risk and uncertainty; Decision trees; Models of decision making.

. Module 4 (project management- 8 hours)

Project Management, Network construction, Arrow diagram, Redundancy. CPM and PERT Networks, Scheduling computations, PERT time estimates, Probability of completion of project, Introduction to crashing.

Module 5 (functional areas of management- 8 hours)

Introduction to functional areas of management, Operations management, Human resources management, Marketing management, Financial management, Entrepreneurship, Business plans, Corporate social responsibility, Patents and Intellectual property rights.

References:

1. H. Koontz, and H. Weihrich, Essentials of Management: An International Perspective. 8th ed., McGraw-Hill, 2009.
2. P C Tripathi and P N Reddy, Principles of management, TMH, 4th edition, 2008.
3. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, Marketing Management: A South Asian Perspective. 14th ed., Pearson, 2012.
4. M. Y. Khan, and P. K. Jain, Financial Management, Tata-McGraw Hill, 2008.
5. R. D. Hisrich, and M. P. Peters, Entrepreneurship: Strategy, Developing, and Managing a New Enterprise, 4th ed., McGraw-Hill Education, 1997.
6. D. J. Sumanth, Productivity Engineering and Management, McGraw-Hill Education, 1985.
7. K.Ashwathappa, 'Human Resources and Personnel Management', TMH, 3 rd edition, 2005.
8. R. B. Chase, Ravi Shankar and F. R. Jacobs, Operations and Supply Chain Management, 14th ed. McGraw Hill Education (India), 2015.

Sample Course Level Assessment Questions

Course Outcome1 (CO1): Explain the systems approach to management?

Course Outcome 2 (CO2): Explain the following terms with a suitable example Goal, Objective, and Strategy.

Course Outcome 3 (CO3): Mr. Shyam is the author of what promises to be a successful novel. He has the option to either publish the novel himself or through a publisher. The publisher is offering Mr. Shyam Rs. 20,000 for signing the contract. If the novel is successful, it will sell 200,000 copies. Else, it will sell 10,000 copies only. The publisher pays a Re. 1 royalty per copy. A market survey indicates that there is a 70% chance that the novel will be successful. If Mr. Shyam undertakes publishing, he will incur an initial cost of Rs. 90,000 for printing and marketing., but each copy sold will net him Rs. 2. Based on the given information and the

decision analysis method, determine whether Mr. Shyam should accept the publisher's offer or publish the novel himself.

Course Outcome 4 (CO4): Explain the concepts of crashing and dummy activity in project management.

Course Outcome 5 (CO5): Derive the expression for the Economic order quantity (EOQ)?

Course Outcome 6 (CO6): Briefly explain the theories of Entrepreneurial motivation.?

Model Question Paper

QP CODE: PAGES: 4

Reg No:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 310

Course name: Management for Engineers

Max Marks: 100 **Duration: 3 Hours**

PART-A (Answer All Questions. Each question carries 3 marks)

1. "Management is getting things done through other." Elaborate.

2. Comment on the true nature of management. Is it a science or an art?

3. Planning is looking ahead and controlling is looking back. Comment with suitable examples

4. Explain the process of communication?

5. Explain the hierarchy of objectives?

6. Explain the types of decisions?

7. Describe the Economic man model?

8. Explain the concepts of crashing and dummy activity in project management.

9. Differentiate the quantitative and qualitative methods in forecasting.

10. What are the key metrics for sustainability measurement? What makes the measurement and reporting of sustainability challenging?

PART-B (Answer any one question from each module)

11. a) Explain the systems approach to management. **(10)**

b) Describe the roles of a manager **(4)**

OR

12. a) Explain the 14 principles of administrative management? **(10)**

b) Explain the different managerial skills (**4)**

13. a) What are planning premises, explain the classification of planning premises. **(10)**

b) Distinguish between strategy and policy. How can policies be made effective. **(4)**

OR

14 a) Explain three motivational theories. **(9)**

b) Describe the managerial grid. **(5)**

15. a) Modern forest management uses controlled fires to reduce fire hazards and to stimulate new forest growth. Management has the option to postpone or plan a burning. In a specific forest tract, if burning is postponed, a general administrative cost of Rs. 300 is incurred. If a controlled burning is planned, there is a 50% chance that good weather will prevail and burning will cost Rs. 3200. The results of the burning may be either successful with probability 0.6 or marginal with probability 0.4. Successful execution will result in an estimated benefit of Rs. 6000, and marginal execution will provide only Rs. 3000 in benefits. If the weather is poor, burning will be cancelled incurring a cost of Rs. 1200 and no benefit. i) Develop a decision tree for the problem. (ii) Analyse the decision tree and determine the optimal course of action. **(8)**

b) Student tuition at ABC University is $100 per semester credit hour. The Education department supplements the university revenue by matching student tuition, dollars per dollars. Average class size for typical three credit course is 50 students. Labour costs are $4000 per class, material costs are $20 per student, and overhead cost are $25,000 per class. (a) Determine the total factor productivity. (b) If instructors deliver lecture 14 hours per week and the semester lasts for 16 weeks, what is the labour productivity? **(6)**

OR

16. a) An ice-cream retailer buys ice cream at a cost of Rs. 13 per cup and sells it for Rs. 20 per cup; any remaining unsold at the end of the day, can be disposed at a salvage price of Rs. 2.5 per cup. Past sales have ranged between 13 and 17 cups per day; there is no reason to believe that

sales volume will take on any other magnitude in future. Find the expected monetary value and EOL, if the sales history has the following probabilities: **(9)**

Market Size	13	14	15	16	17
Probability	0.10	0.15	0.15	0.25	0.35

b) At Modem Lumber Company, Kishore the president and a producer of an apple crates sold to growers, has been able, with his current equipment, to produce 240 crates per 100 logs. He currently purchases 100 logs per day, and each log required 3 labour hours to process. He believes that he can hire a professional buyer who can buy a better quality log at the same cost. If this is the case, he increases his production to 260 crates per 100 logs. His labour hours will increase by 8 hours per day. What will be the impact on productivity (measured in crates per labour-hour) if the buyer is hired? What is the growth in productivity in this case? **(5)**

17. a) A project has the following list of activities and time estimates:

Activity	**Time (Days)**	**Immediate Predecessors**
A	1	-
B	4	A
C	3	A
D	7	A
E	6	B
F	2	C, D
G	7	E, F
H	9	D
I	4	G, H

(a) Draw the network. (b) Show the early start and early finish times. (c) Show the critical path. **(10)**

b) An opinion survey involves designing and printing questionnaires, hiring and training personnel, selecting participants, mailing questionnaires and analysing data. Develop the precedence relationships and construct the project network. **(4)**

OR

18. a) The following table shows the precedence requirements, normal and crash times, and normal and crash costs for a construction project:

Activity	Immediate Predecessors	Required Time (Weeks)		Cost (Rs.)	
		Normal	Crash	Normal	Crash
A	-	4	2	10,000	11,000
B	A	3	2	6,000	9,000
C	A	2	1	4,000	6,000
D	B	5	3	14,000	18,000
E	B, C	1	1	9,000	9,000
F	C	3	2	7,000	8,000
G	E, F	4	2	13,000	25,000
H	D, E	4	1	11,000	18,000
I	H, G	6	5	20,000	29,000

Draw the network. (b) Determine the critical path. (c) Determine the optimal duration and the associated cost. **(10)**

b) Differentiate between CPM and PERT. **(4)**

19. a) What is meant by market segmentation and explain the process of market segmentation **(8)**

b) The Honda Co. in India has a division that manufactures two-wheel motorcycles. Its budgeted sales for Model G in 2019 are 80,00,000 units. Honda's target ending inventory is 10,00, 000 units and its beginning inventory is 12, 00, 000 units. The company's budgeted selling price to its distributors and dealers is Rs. 40, 000 per motorcycle. Honda procures all its wheels from an

outside supplier. No defective wheels are accepted. Honda's needs for extra wheels for replacement parts are ordered by a separate division of the company. The company's target ending inventory is 3,00,000 wheels and its beginning inventory is 2,00,000 wheels. The budgeted purchase price is Rs. 1,600 per wheel.

(a) Compute the budgeted revenue in rupees.

(b) Compute the number of motorcycles to be produced.

Compute the budgeted purchases of wheels in units and in rupees.? **(6)**

OR

20. a) a) "Human Resource Management policies and principles contribute to effectiveness, continuity and stability of the organization". Discuss. (b) What is a budget? Explain how sales budget and production budgets are prepared? **(10)**

b) Distinguish between the following: (a) Assets and Liabilities (b) Production concept and Marketing concept (c) Needs and Wants (d) Design functions and Operational control functions in operations **(4)**

Teaching Plan

Sl.No	TOPIC	SESSION
	Module I	
1.1	Introduction to management	1
1.2	Levels of managers and skill required	2
1.3	Classical management theories	3
1.4	neo-classical management theories	4
1.5	modern management theories	5
1.6	System approaches to Management,	6
1.7	Task and Responsibilities of a professional Manager	7
	Module 2	
2.1	Management process – planning	8
2.2	Mission – objectives – goals – strategy – policies – programmes – procedures	9
2.3	Organizing, principles of organizing, organization structures	10
2.4	Directing, Leadership	11
2.5	Motivation, Controlling	12
	Module III	
3.1	Concept of productivity and its measurement Competitiveness	13
3.2	Decision making process;	14
3.3	Models in decision making	15
3.4	Decision making under certainty and risk	16
3.5	Decision making under uncertainty	17
3.6	Decision trees	18
3.7	Models of decision making.	19
	Module IV	
4.1	Project Management	20

Sl.No	TOPIC	SESSION
	Module I	
4.2	Network construction	21
4.3	Arrow diagram, Redundancy	22
4.4	CPM and PERT Networks	23
4.5	Scheduling computations	24
4.6	PERT time estimates	25
4.7	Probability of completion of project	26
4.8	Introduction to crashing	
	Module V	
5.1	Introduction to functional areas of management,	28
5.2	Operations management	29
5.3	Human resources management ,	30
5.4	Marketing management	31
5.5	Financial management	32
5.6	Entrepreneurship,	33
5.7	Business plans	34
5.8	Corporate social responsibility, Patents and Intellectual property rights	35

MCN 301	DISASTER MANAGEMENT	Category	L	T	P	CREDIT	YEAR OF INTRODUCTION
		Non - Credit	2	0	0	Nil	2019

Preamble: The objective of this course is to introduce the fundamental concepts of hazards and disaster management.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	Define and use various terminologies in use in disaster management parlance and organise each of these terms in relation to the disaster management cycle (Cognitive knowledge level: **Understand**).
CO2	Distinguish between different hazard types and vulnerability types and do vulnerability assessment (Cognitive knowledge level: **Understand**).
CO3	Identify the components and describe the process of risk assessment, and apply appropriate methodologies to assess risk (Cognitive knowledge level: **Understand**).
CO4	Explain the core elements and phases of Disaster Risk Management and develop possible measures to reduce disaster risks across sector and community (Cognitive knowledge level: **Apply**)
CO5	Identify factors that determine the nature of disaster response and discuss the various disaster response actions (Cognitive knowledge level: **Understand**).
CO6	Explain the various legislations and best practices for disaster management and risk reduction at national and international level (Cognitive knowledge level: **Understand**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2
CO1		2				2				2		2
CO2	2	3	2		2	2	3			3		2
CO3	2	3	2	2	2	2	3			3		2
CO4	3	3	3		2	2	3					2
CO5	3	3			2	2	3					2
CO6	3					2	3	3				2

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	**10**	**10**	**20**
Understand	**25**	**25**	**50**
Apply	**15**	**15**	**30**
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**50**	**100**	**3 hours**

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment - Test : 25 marks

Continuous Assessment - Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A.

Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

SYLLABUS

MCN 301 Disaster Management

Module 1

Systems of earth

Lithosphere- composition, rocks, soils; Atmosphere-layers, ozone layer, greenhouse effect, weather, cyclones, atmospheric circulations, Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere

Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counselling, needs assessment.

Module 2

Hazard types and hazard mapping; Vulnerability types and their assessment- physical, social, economic and environmental vulnerability.

Disaster risk assessment –approaches, procedures

Module 3

Disaster risk management -Core elements and phases of Disaster Risk Management

Measures for Disaster Risk Reduction – prevention, mitigation, and preparedness.

Disaster response- objectives, requirements; response planning; types of responses.

Relief; international relief organizations.

Module 4

Participatory stakeholder engagement; Disaster communication- importance, methods, barriers; Crisis counselling

Capacity Building: Concept – Structural and Non-structural Measures, Capacity Assessment; Strengthening Capacity for Reducing Risk

Module 5

Common disaster types in India; Legislations in India on disaster management; National disaster management policy; Institutional arrangements for disaster management in India.

The Sendai Framework for Disaster Risk Reduction- targets, priorities for action, guiding principles

Reference Text Book

1. R. Subramanian, Disaster Management, Vikas Publishing House, 2018
2. M. M. Sulphey, Disaster Management, PHI Learning, 2016
3. UNDP, Disaster Risk Management Training Manual, 2016
4. United Nations Office for Disaster Risk Reduction, Sendai Framework for Disaster Risk Reduction 2015-2030, 2015

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?
2. What are disasters? What are their causes?
3. Explain the different types of cyclones and the mechanism of their formation
4. Explain with examples, the difference between hazard and risk in the context of disaster management
5. Explain the following terms in the context of disaster management (a) exposure (b) resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment

Course Outcome 2 (CO2):

1. What is hazard mapping? What are its objectives?
2. What is participatory hazard mapping? How is it conducted? What are its advantages?
3. Explain the applications of hazard maps
4. Explain the types of vulnerabilities and the approaches to assess them

Course Outcome 3 (CO3):

1. Explain briefly the concept of ‘disaster risk’

2. List the strategies for disaster risk management ‘before’, ‘during’ and ‘after’ a disaster
3. What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy

Course Outcome 4 (CO4):

1. What is disaster prevention? Distinguish it from disaster mitigation giving examples
2. What are the steps to effective disaster communication? What are the barriers to communication?
3. Explain capacity building in the context of disaster management

Course Outcome 5 (CO5):

1. Briefly explain the levels of stakeholder participation in the context of disaster risk reduction
2. Explain the importance of communication in disaster management
3. Explain the benefits and costs of stakeholder participation in disaster management
4. How are stakeholders in disaster management identified?

Course Outcome 6 (CO6):

1. Explain the salient features of the National Policy on Disaster Management in India
2. Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction
3. What are Tsunamis? How are they caused?
4. Explain the earthquake zonation of India

Model Question paper

QP CODE: **PAGES:3**

Reg No:_____ **Name :_____**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MCN 301

Course Name: Disaster Management

Max.Marks:100 **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?
2. What are disasters? What are their causes?
3. What is hazard mapping? What are its objectives?
4. Explain briefly the concept of 'disaster risk'
5. List the strategies for disaster risk management 'before', 'during' and 'after' a disaster
6. What is disaster prevention? Distinguish it from disaster mitigation giving examples
7. Briefly explain the levels of stakeholder participation in the context of disaster risk reduction
8. Explain the importance of communication in disaster management
9. What are Tsunamis? How are they caused?
10. Explain the earthquake zonation of India

Part B

Answer any one Question from each module. Each question carries 14 Marks

11. a. Explain the different types of cyclones and the mechanism of their formation [10]

b. Explain with examples, the difference between hazard and risk in the context of disaster management
[4]

OR

12. Explain the following terms in the context of disaster management [14]

(a) exposure (b) resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment

13. a. What is participatory hazard mapping? How is it conducted? What are its advantages?

[8]

b. Explain the applications of hazard maps [6]

OR

14. Explain the types of vulnerabilities and the approaches to assess them [14]

15. a. Explain the core elements of disaster risk management [8]

b. Explain the factors that decide the nature of disaster response [6]

OR

16. a. What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy [6]

b. Explain the different disaster response actions [8]

17. a. Explain the benefits and costs of stakeholder participation in disaster management [10]

b. How are stakeholders in disaster management identified? [4]

OR

18. a. What are the steps to effective disaster communication? What are the barriers to communication? [7]

b. Explain capacity building in the context of disaster management [7]

19. Explain the salient features of the National Policy on Disaster Management in India

[14]

OR

20. Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction [14]

Teaching Plan

	Module 1	**5 Hours**
1.1	Introduction about various Systems of earth, Lithosphere-composition, rocks, Soils; Atmosphere-layers, ozone layer, greenhouse effect, weather	1 Hour
1.2	Cyclones, atmospheric circulations, Indian Monsoon; hydrosphere-Oceans, inland water bodies; biosphere	1 Hour
1.3	Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard,	1 Hour
1.4	Exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, Disaster risk management, early warning systems	1 Hour
1.5	Disaster preparedness, disaster prevention, disaster, Mitigation, disaster response, damage assessment, crisis counselling, needs assessment.	1 Hour
	Module 2	**5 Hours**
2.1	Various Hazard types, Hazard mapping; Different types of Vulnerability types and their assessment	1 Hour
2.2	Vulnerability assessment and types, Physical and social vulnerability	1 Hour
2.3	Economic and environmental vulnerability, Core elements of disaster risk assessment	1 Hour
2.4	Components of a comprehensive disaster preparedness strategy approaches, procedures	1 Hour
2.5	Different disaster response actions	1 Hour
	Module 3	**5 Hours**
3.1	Introduction to Disaster risk management, Core elements of Disaster Risk Management	1 Hour
3.2	Phases of Disaster Risk Management, Measures for Disaster Risk Reduction	1 Hour
3.3	Measures for Disaster prevention, mitigation, and preparedness.	1 Hour

3.4	Disaster response- objectives, requirements. Disaster response planning; types of responses.	1 Hour
3.5	Introduction- Disaster Relief, Relief; international relief organizations.	1 Hour
	Module 4	**5 Hours**
4.1	Participatory stakeholder engagement	1 Hour
4.2	Importance of disaster communication.	1 Hour
4.3	Disaster communication- methods, barriers. Crisis counselling	1 Hour
4.4	Introduction to Capacity Building. Concept – Structural Measures, Non-structural Measures.	1 Hour
4.5	Introduction to Capacity Assessment, Capacity Assessment; Strengthening, Capacity for Reducing Risk	1 Hour
	Module 5	**5 Hours**
5.1	Introduction-Common disaster types in India.	1 Hour
5.2	Common disaster legislations in India on disaster management	1 Hour
5.3	National disaster management policy, Institutional arrangements for disaster management in India.	1 Hour
5.4	The Sendai Framework for Disaster Risk Reduction and targets	1 Hour
5.5	The Sendai Framework for Disaster Risk Reduction-priorities for action, guiding principles	1 Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MRL331	PLC AND DATA ACQUISITION LAB	PCC	0	0	3	2

Preamble: This course enables students to students to practice the applications of data acquisition and PLC systems experimentally.

Prerequisite: MRT 305 PLC AND DATA ACQUISITION SYSTEMS

Course Outcomes: After the completion of the course the student will be able to

CO 1	Experimentally test and familiarize the characteristics of strain gauge , load cell, LVDT, thermocouple, thermostat and LDR using measurements kits
CO 2	Understand about basics of PLC
CO 3	Implement the PLC program for logic gates and flipflops and apply in hardware and simulation
CO 4	Simulate and implement various control operations using PLC hardware and software

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	2	-	-	-	-	-	3	-	-	2
CO 2	3	-	2	-	-	-	-	-	3	-	-	2
CO 3	3	2	3	2	3	-	-	-	3	-	-	3
CO 4	3	3	3	3	3	-	-	-	3	-	-	3

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks
(a) Preliminary work : 15 Marks

(b) Implementing the work/Conducting the experiment : 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting) : 25 Marks
(d) Viva voce : 20 marks
(e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the role of LVDT in data acquisition? What are its characteristics?
2. What do you infer from the strain gauge characteristics?
3. How can you make use of thermocouple in data acquisition?

Course Outcome 2 (CO2)

1. Draw and explain a ladder diagram.
2. What are the commercially available PLCs?
3. Explain the working of a PLC.

Course Outcome 3(CO3):

1. Implement a universal gate using PLC.
2. Implement a counter using PLC.
3. Implement the SR flip flop using PLC.

Course Outcome 4 (CO4):

1. Implement a timer circuit for traffic signal control using PLC.
2. Implement a level control circuit for an overhead tank using PLC.
3. Develop a controller for stepper motor control using PLC.

LIST OF EXPERIMENTS :(Minimum 12 experiments is mandatory)

1. Strain gauge characteristics
2. Load cell characteristics
3. LVDT characteristics
4. Characteristics of thermocouples
5. Characteristics of RTD
6. Characteristics of thermostats

7. LDR and opto coupler characteristics
8. AD590 Characteristics
9. Capacitive transducer characteristics
10. Study of PLC
11. Implementation of logic gates using PLC
12. Implementation of Flip flops using PLC
13. Implementation of timers and counters using PLC
14. Tank level control using PLC – simulation
15. Sequential switching of motors using PLC simulation
16. To construct sequencer using bit logic instruction only

Text Books

1. Hughes . T, “Programmable Logic Controllers” , ISA press, 1989
2. Petrezeulla, “Programmable Logic Controllers”, McGraw Hill, 1989.
3. Curtis D. Johnson,” Process Control Instrumentation Technology”, 8th edition Prentice Hall June 2005

CODE	INSRTUMENTATION LAB	CATEGORY	L	T	P	CREDIT
MRL333		PCC	0	0	3	2

Preamble: This course enables students to students to familiarize various instruments and practice them for applications in automation.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the calibration and use of different measuring instruments
CO 2	Evaluate the uncertainties involved in any measurement
CO 3	Understand and analyze construction and operational aspects of different electro-mechanical measuring instruments along with their application domains
CO 4	Explain the need of various modern measuring instruments and precision measurement techniques
CO 5	Develop knowledge on the fundamental concepts and principles of metrology
CO 6	Study the operating principle and analyse the output characteristics of different electronics instruments

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3	2							2			2
CO 3	3	2							2			
CO 4	3	2	2									2
CO 5	3	2							2			
CO 6	3		2						2			2

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance	:	15 marks
Continuous Assessment	:	30 marks
Internal Test (Immediately before the second series test)	:	30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work : 15 Marks
(b) Implementing the work/Conducting the experiment : 10 Marks
(c) Performance, result and inference (usage of equipment and trouble shooting) : 25 Marks
(d) Viva voce : 20 marks
(e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Mention some of the transducers.

2. The temperature coefficient of material should be high or low?

3. What is the value of excitationvoltage?

Course Outcome 2 (CO2)

1. Define Skin effect?

2. what are errors in this instrument?

3. Define self heating property of thermistor?

Course Outcome 3(CO3):

1. Give commonly used pressure sensitive devices?

2. What is the working principle of mercury in glass thermometer?

3. What is the nature of EMF induced in thermocouple?

Course Outcome 4 (CO4):

1. Why calibration is essential and how it is performed for a strain gauge?

2. What is Torque?

3. Are RTDs and thermocouples intrinsically safe?

Course Outcome 5 (CO5):

1. What is the relation between variation due to observation, manufacturing process and measuring process of a product?

2. What is the least count of clinometer which is used to check reading of column rotation used for setting of helix angles in universal micro meter?

3.What is the difference unilateral and bilateral system of tolerance? Discuss the least count of a verniercalliper?

Course Outcome 6 (CO6):

1.What do you meant by Basic size?

2. What is the sensitivity of Wheatstone bridge

3. The characteristics of thermistor in linear or non-linear?

LIST OF EXPERIMENTS (Minimum 12 experiments is mandatory)

1) Calibration of Bourdon tube pressure gauge using dead weight pressure gauge tester.

2) Calibration of strain gauge pressure cell

3) Measurement of temperature using Radiation pyrometer and infrared pyrometer

4] Time constant of temperature measuring device

5) Measurement of vibration using Piezoelectric Accelerometers

6) Measurement of vibration using vibrometers

7) Measurement of torque and force

Measurement of cutting force during turning, drilling and milling using tool force dynamometer

8) Acoustic measurement using Sound level meter and octave band filter

9) Preparation of noise Contours

10) Calibration of tachometers

11) Measurement of rotation speed using tachometer, tacho generator and stroboscopic tachometer

12) Metrology

Measurement of surface finish using stylus type surface roughness measuring device

13) Measurement of tool wear using tool makers microscope

14) Study and use of linear and angular measuring devices-verniercaliper, outside and inside micrometer, vernier depth gauge, vernier height gauge, feeler gauge, screw pitch gauge, sine bar, slip gauge- bevel protractor- profile projector

15) Measurements of gears and screw threads

16) Analysis of exhaust gases and flue gases with the help of orsats apparatus, Gas chromatograph, paramagnetic oxygen analyser, smoke meter etc.

Reference Books

1.Advanced laboratory manual of parasitology and immunopharmacology by MANNA

2. Electrical Measurements in the Laboratory Practice ByBartiromo, Rosario**,** De Vincenzi**,** Mario

3. Basic Theory and Laboratory Experiments in Measurement and Instrumentation:by Cataldo, A., Giaquinto, N., De Benedetto, E., Masciullo, A., Cannazza, G., Lorenzo, I., Nicolazzo, J., Meo, M.T., Monte, A.D., Parisi, G., Gaetani, F.