FMTH0301/Rev.5.3

Course Plan

Semester: **FIRST SEMESTER** Year: **2021-2022**

Course Title: **Basic Mechanical Engineering**	Course Code: **15EMEF101**
Total Contact Hours: **40**	Duration of ESA: 3 Hours
ESA Marks: **50**	ISA Marks: **50**
Lesson Plan Author: Adarsh Patil, Shivanand P P	Date: 15-11-2021
Checked By: Dr B. B. Kottursheettar	Date: 28-11-2021

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Summarize mechanical engineering profession, its achievements and contribution to Indian economy
2. Explain the various power transmission devices and accessories used in Mechanical and Automotive industry
3. Identify the various machine tools used in manufacturing industry and the various operations used to give required shape, size and finish to the components
4. Discuss the working principle of prime movers/ heat engines viz. steam turbine and internal combustion engine
5. Narrate the working principle of reversed heat engine viz. Refrigerator and its application
6. Create 3D models of engineering components using CAD software.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Title: Basic Mechanical Engineering	Semester: **FIRST SEMESTER**
Course Code: 15EMEF101	Year: 2021-2022

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1. Summarize mechanical engineering profession, its achievements and contribution to Indian economy	**M**	**L**										
2. Explain the various power transmission devices and accessories used in Mechanical and Automotive industry	**M**	**L**										
3. Identify the various machine tools used in manufacturing industry and the various operations used to give required shape, size and finish to the components	**M**	**L**										
4. Discuss the working principle of prime movers/ heat engines viz. steam turbine and internal combustion engine	**M**	**L**										
5. Narrate the working principle of reversed heat engine viz. Refrigerator and its application	**M**	**L**										
6. Create 3D models of engineering components using CAD software.					**M**							

Degree of compliance **L**: Low **M**: Medium **H**: High

Competency addressed in the Course and corresponding Performance Indicators

Competency	Performance Indicators
1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply fundamental engineering principles and laws to solve engineering problems
2.1 Demonstrate an ability to identify and characterize an engineering problem	2.1.3 Identifies the mathematical, engineering and other relevant knowledge that applies to a given problem
2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.3 Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions
5.1 Demonstrate an ability to identify/create modern engineering tools, techniques and resources	5.1.1 Identify modern engineering tools such as computer aided drafting, modelling and analysis; techniques and resources for engineering activities

Eg: 1.2.3: Represents Program Outcome '1', Competency '2' and Performance Indicators '3'.

Course Content

Course Code: 15EMEF101	Course Title: Basic Mechanical Engineering	
L-T-P: 2-1-0-0	Credits: 3	Contact Hours: 40
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 24		Exam Duration: 3 hrs

Content	Hrs
Unit - 1	
Chapter No. 1: Introduction to Mechanical Engineering Mechanical Engineering, Mechanical Engineers' top ten achievements, Branches of Mechanical Engineering, Mechanical product Example: Pressure Cooker.	3 hrs
Chapter No. 2: Design Engineering: Power Transmission Elements Overview Design Application: • Belt Drives. Types, Length of Belt. Velocity Ratio, Initial Tension. Ratio of Tensions. Power Transmitted, Numerical Problems. • Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and Power in Gear pair. Simple and Compound Gear trains. Numerical	5 hrs

Problems. • Ball and Roller Bearings, Types, Applications.	
Unit - 2	
Chapter No. 3: Manufacturing Engineering: Basics of Manufacturing What is manufacturing?, Classification of manufacturing processes, Electric Arc Welding, Gas Welding, Lathe machine: Working and different operations, Milling machine: Working and different operations, Drilling Machine: Working and different operations, Grinding Machines: Working and different operations, Scales of production. Advances in manufacturing: CNC machines.	5 hrs
Chapter No. 4: Thermal Engineering 1: Prime movers Steam, properties of steam, applications of steam-steam turbines. Internal Combustion Engines: Classification, IC engine parts, 2 stroke SI and CI engine, 4 Stroke SI and CI Engine, PV diagrams of Otto and Diesel cycles, Comparison of 2 stroke and 4 stroke engine, comparison of CI and SI engine, Numerical problems on Engine Performance.	7 hrs
Unit - 3	
Chapter No. 5: Thermal Engineering 2: Thermal Systems' Applications Refrigeration system, Air conditioning system, Pumps, Blowers and Compressors and their working principle and specifications.	4 hrs

Course Content with Tutorial:

Course Code: 15EMEF101	Course Title: Basic Mechanical Engineering		L-T-P: 2-1-0	
Contact Hours: 4 hrs/week	Teaching Hours: 24 + 16 (Tutorials)		ISA: 50marks	ESA: 50marks

Chapter No	Contents	No. of Hours	Tutorial	No. of sessions
	Unit-I			
1	**Introduction to Mechanical Engineering:** Mechanical Engineering, Who are Mechanical Engineers? Mechanical Engineers' top ten achievements, Branches of Mechanical Engineering, Mechanical product Example: Pressure Cooker, The main manufacturing sectors.	3	Virtual Prototyping: 2D sketching, 3D modelling-Extrude, Revolve, Pattern. Sheet Metal. Assembly.	4
2	**Design Engineering: Power Transmission Elements** Overview Design Application: • Belt Drives. Types, Length of Belt. Velocity Ratio, Initial Tension. Ratio of Tensions. Power Transmitted, Numerical Problems. • Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and Power in Gear pair. Simple and Compound Gear trains. Numerical Problems. Ball and Roller Bearings, Types, Applications.	5		
	Unit-II			
3	**Manufacturing Engineering: Basics of Manufacturing** What is manufacturing? Classification of manufacturing Processes,	5	Workshop: • Welding Shop, Sheet metal shop, Machine Shop.	4

	Scales of production. Advances in Manufacturing: CNC machines.		• Demonstration of various tools of fitting shop. Safety Precautions in workshop. • Assembly and Disassembly of Bicycle and Demonstration on Welding (Electric Arc Welding, Gas Welding). • Demonstration and Exercise on Sheet metal work. • Demonstration on working of Lathe and drilling Machine, • Demonstration on working of Milling and Grinding machines.	
4	**Thermal Engineering 1: Prime movers** Steam, properties of steam, applications of steam-steam turbines. Internal Combustion Engines: Classification, IC engine parts, 2 stroke SI and CI engine, 4 Stroke SI and CI Engine, PV diagrams of Otto and Diesel cycles, Comparison of 2 stroke and 4 stroke engine, comparison of CI and SI engine, Problems on Engine Performance, Recent trends in IC engines	7		
Unit-III				
5	**Thermal Engineering 2: Thermal Systems' Applications** Refrigeration system and Air conditioning system. Pumps, Blowers and Compressors, and their working principle and specifications.	4		

Text Books (List of books as mentioned in the approved syllabus)

1. Jonathan Wickert and Kemper Lewis, An Introduction to Mechanical Engineering, Third Edition, Cengage Learning, 2013
2. K.R.Gopalkrishna, Sudhir Gopalkrishna, S.C. Sharma, A Text Book of Elements of Mechanical Engineering, 30th Edition, Subhash Publishers, Bangalore, 2010
3. Dr. N. Krishnamurthy, Dr. H. S. Manohar, Mr. Sagar M. Baligidad, Elements of Mechanical Engineering, First Edition, Sunstar Publisher, 2014

References

1. SKH Chowdhary, AKH Chowdhary, Nirjhar Roy, The Elements of Workshop Technology, Vol I & II, 11th edition, Media Promoters and Publishers, 2001
2. Roger Timings, Basic Manufacturing, Third edition, Newnes, An imprint of Elsevier, 2010

Evaluation Scheme

ISA Scheme

Assessment	Weightage in Marks
Minor 1	15
Minor 2	15
Post Test	10
Sheet Metal work	4
Case Study Assignment(3D modelling)	6
ESA	50
Total	**100**

Course Unitization for Minor Exams and Semester End Examination

Topics / Chapters	Teaching Hours	No. of Questions in Minor 1	No. of Questions in Minor 2	No. of Questions in ESA
Introduction to Mechanical Engineering	3	1.00	--	1.00
Design Engineering: Power Transmission Elements	5	2.00	--	2.00
Manufacturing Engineering: Basics of Manufacturing	5	--	1.50	1.50
Thermal Engineering 1: Prime movers	7	--	1.50	1.50
Thermal Engineering 2: Thermal Systems Applications	4	--	--	2.00

Note

1. Each Question carries 20 marks and may consist of sub-questions.
2. Mixing of sub-questions from different chapters within a unit (only for Unit I and Unit II) is allowed in Minor I, II and ESA.
3. Answer 5 full questions of 20 marks each (two full questions from Unit I, II and one full question from Unit III) out of 8 questions in ESA.

Course Assessment Plan

Course Title: Basic Mechanical Engineering Code: 15EMEF101							
Course outcomes (COs)	Weightage in assessment	Assessment Methods					
		Minor 1	Minor 2	Post test	Assignments	ESA	
1. Summarize mechanical engineering profession, its achievements and contribution to Indian economy	13%	✓		✓		✓	
2. Explain the various power transmission devices and accessories used in Mechanical and Automotive industry	25%	✓		✓		✓	
3. Identify the various machine tools used in manufacturing industry and the various operations used to give required shape, size and finish to the components	20%		✓	✓	✓	✓	
4. Discuss the working principle of prime movers/ heat engines viz. steam turbine and internal combustion engine	23%		✓	✓		✓	
5. Narrate the working principle of reversed heat	13%			✓		✓	

engine viz. Refrigerator and its application							
6. Create 3D models of engineering components using CAD software.	6%				✓		
Weightage		15 %	15 %	10 %	10%	50%	

Date: 28-11-2021 **Head of Department**

Chapter wise Plan

Course Code and Title: **15EMEF101 / Basic Mechanical Engineering**	
Chapter Number and Title: **1. Introduction to Mechanical Engineering**	Planned Hours: **5 hrs**

Learning Outcomes:-

At the end of the topic the student should be able to:

Topic Learning Outcomes	COs	BL	CA Code
1. Explain the term "Engineering and Mechanical Engineering"	CO1	L2	1.3
2. Enumerate the achievements of Mechanical Engineering	CO1	L2	1.3
3. Analyse roles of various inter-disciplinary engineering streams in manufacturing sector	CO1	L4	1.3, 2.1

Lesson Schedule Class No. - Portion covered per hour / per Class
1. Definition of engineering, Mechanical Engineering, Who are Mechanical Engineers?
2. Mechanical Engineers' top ten achievements, Branches of Mechanical Engineering
3. Mechanical product Example: Pressure Cooker

Review Questions

Sl.No. - Questions	TOs	BL	PI Code
1. For each of the following systems, give two examples of how a mechanical engineer would be involved in its design. (a) Passenger automobile engine. (b) Escalator. (c) Computer hard disk drive. (d) Artificial hip implant. (e) Cricket Ball pitching machine.	3	L3	1.3.1
2. For each of the following systems, give two examples of how a mechanical engineer would be involved in its manufacturing. (a) Jet engine for a commercial airliner. (b) Rover robot for planetary exploration. (c) Computer ink-jet printer. (d) Smart phone. (e) Can of Soft Drink from a vending machine.	3	L3	1.3.1
3. For each of the following systems, give two examples of how a mechanical engineer would be involved in the thermal aspects of	3	L3	1.3.1

these systems. (a) Passenger automobile engine. (b) Toaster. (c) Computer hard disk drive. (d) IC Chip. (e) Air Conditioner.			
4. With a neat flow chart, Briefly explain the manufacturing of Pressure cooker	3	L2	2.1.3
5. Explain the three main branches of Mechanical Engineering	1	L2	1.3.1
6. Explain the contribution of three main branches of mechanical engineering towards the design and production of Pressure Cooker.	3	L2	2.1.3
7. Explain any two of the top ten achievements of Mechanical Engineering.	2	L2	1.3.1

Model post test questions for Chapter 1

S.No	Questions	CO	BL	PI
1	The branch of engineering that specializes in the design, production and uses of machines. A. Mechanical Engineering B. Aeronautical Engineering C. Computer Science Engineering D. All of the above	1	L1	1.3.1
2	ASME refers to A. The Aeronautical Society of Mechanical Engineers B. The American Society of Mechanical Engineers 0·1 mm C. Both A and B are correct. D. None of the above	1	L1	1.3.1
3	Bioengineering is an achievement of Mechanical Engineers as stated by ASME. A. TRUE B. FALSE	1	L1	1.3.1
4	The third main stream of Mechanical Engineering along with Design Engineering and Manufacturing Engineering is A. Aeronautical Engineering B. Tool Engineering C. Thermal Engineering D. None of the above	1	L1	1.3.1

5	In the Manufacturing of Pressure Cooker , the question "What should be the maximum pressure to be achieved within the cooker for safe utility? " has to be decided by _____ stream of Mechanical Engineering A. Design Stream B. Manufacturing Stream C. Thermal Stream D. All of the above	1	L2	2.1.3
6	In the Manufacturing of Pressure Cooker, the aspects like Drive motors for working of the various machinery, Safety aspects concerned with electrical systems in industry are to be handled by A. Electronics Engineers B. Electrical Engineers C. Mechanical Engineers D. All of the above	1	L2	2.1.3
7	Wind mills, Solar and Ocean energy are part of _____ achievement of Mechanical Engineers. and A. The Automobile B. The Air Plane C. Power Generation D. All of the above	1	L1	1.3.1
8	Miniaturizing integrated circuits, computer memory chips, and microprocessors is also part of achievement of Mechanical Engineers as stated by ASME. A. TRUE B. FALSE	1	L1	1.3.1
9	Vibrations, Dynamics and Kinematics are some of the courses learnt by Mechanical Engineers under A. Design Stream B. Manufacturing Stream C. Thermal Stream D. All of the above	1	L1	1.3.1
10	Thermodynamics, Fluid mechanics and Heat transfer are some of the courses learnt by Mechanical Engineers under A. Design Stream B. Manufacturing Stream C. Thermal Stream D. All of the above	1	L1	1.3.1

Course Code and Title: **15EMEF101 / Basic Mechanical Engineering**	
Chapter Number and Title: **2. Design Engineering: Power Transmission Elements**	Planned Hours: **5 hrs**

Learning Outcomes:-

At the end of the topic the student should be able to:

Topic Learning Outcomes	COs	BL	CA Code
1. Recognise the kind of power transmission drive depending on speed, power and distance between the shafts.	CO3	L3	2.1
2. Calculate the length of belt, velocity ratio and power transmitted by a belt drive.	CO3	L3	2.1
3. Discuss the circumstances in which one type of gear would be selected for use over another.	CO3	L3	2.1
4. Calculate the Speed, Torque, and Power in a Gear pair.	CO3	L3	2.1
5. Explain the necessity of bearings with some applications.	CO3	L3	2.1

Lesson Schedule Class No. - Portion covered per hour / per Class
1. Overview of Power Transmission Drives, Belt Drives. Types, Velocity Ratio, Initial Tension. Numerical Problems.
2. Length of Belt. Ratio of Tensions. Power Transmitted, Numerical Problems
3. Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and Power in Gear pair. Numerical Problems
4. Simple and Compound Gear trains. Numerical Problems
5. Ball and Roller Bearings, Types, Applications.

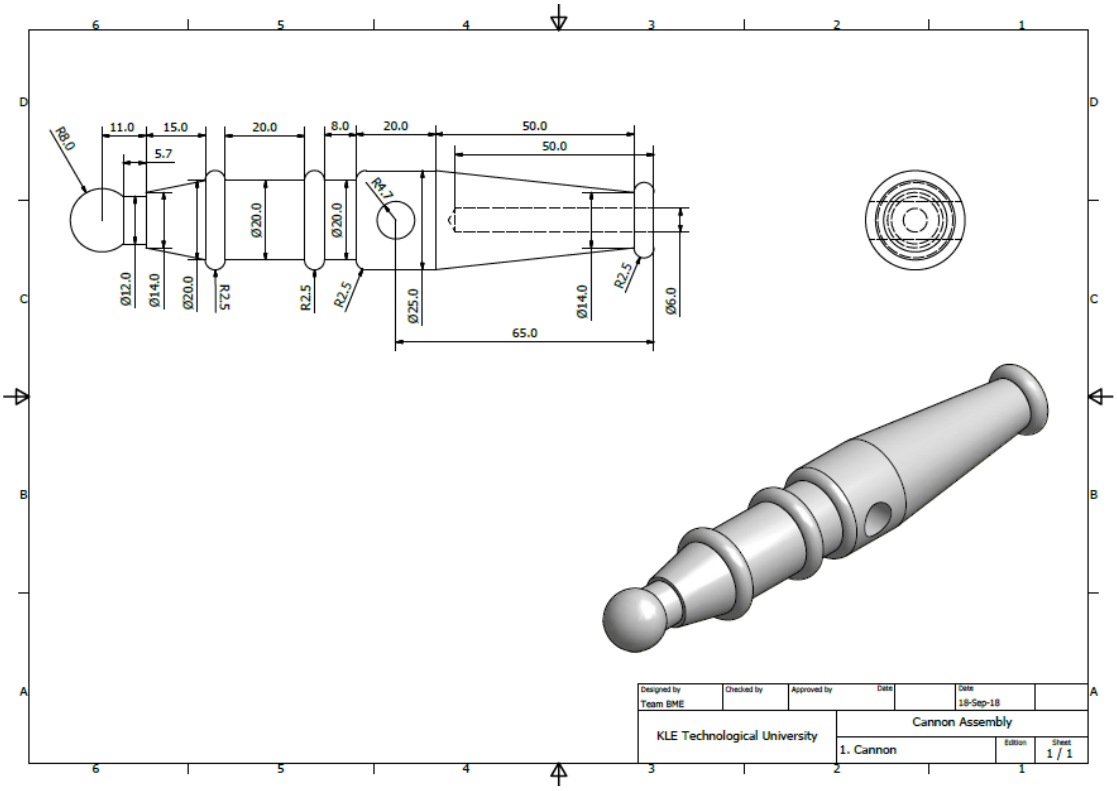
Review Questions

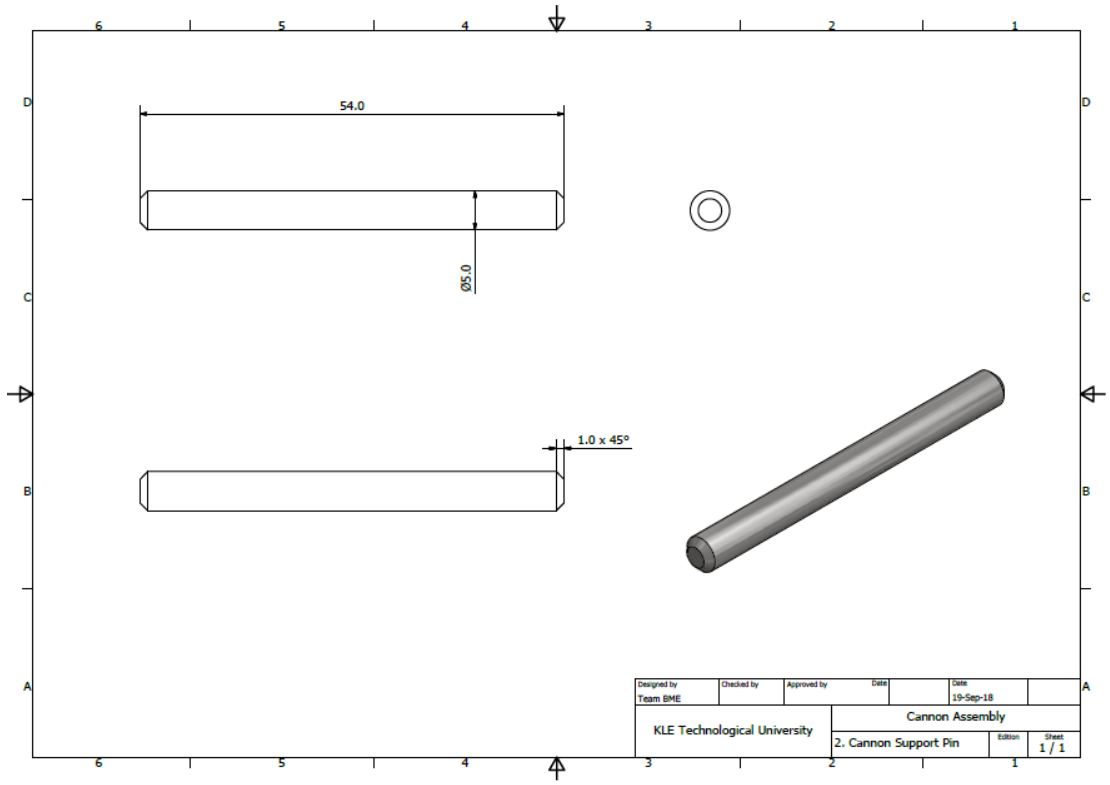
Sl.No. - Questions	TOs	BL	PI Code
1. You being Maintenance engineer of a Flour Mill running on belt drive, what is the equation to determine the length of belt?	2	L3	2.1.3
2. In a radial drilling machine the sum of the diameters of two pulleys A and B connected by a belt is 900 mm. If they run at 700 and 1400 rpm respectively, determine the diameter of each pulley.	2	L2	1.3.1
3. Power is to be transmitted from shaft running at ground floor to a machine at first floor. Suggest and explain a suitable power transmission drive to be used.	1	L3	2.1.3
4. Suggest and explain the kind of belt drive which requires longer length of belt for same Centre distance and size of pulleys?	1	L3	2.1.3
5. If smaller pulley has coefficient of friction 0.3 and larger pulley has coefficient of friction 0.2. The angles of lap on smaller and larger pulleys are 160^o and 200^o which value of ($\mu\theta$) should be used for ratio of tensions?	2	L3	2.2.3
6. On a drilling machine there is a need for some arrangement through which we will be able to achieve 3 different speeds at the spindle with the same input speed given by a motor. Suggest and explain with a neat sketch a suitable solution.	1	L3	2.2.3
7. Suggest and explain with neat sketch the type of gear needed for coplanar intersecting shafts.	3	L3	2.2.3
8. Suggest and explain with neat sketch the type of gear needed for non-coplanar and non-intersecting shafts.	3	L3	2.2.3
9. A spur gear 1 mounted on shaft A has 120 teeth and drives a spur gear pinion 2 having 15 teeth mounted on shaft B. Compounded with gear 2 is a 75 tooth spur gear 3 which drives a 20 tooth spur gear 4 mounted on shaft C. Mounted on the same shaft as gear 4 is a 144 tooth spur gear 5 driving a spur gear 6 which is mounted on shaft D with 172 teeth which is co-linear with the axis of shaft A. All shafts are parallel and in the same plane. Make a sketch of the gear train and identify components. If the gear 1 runs at 500 rpm find the velocity ratio of the gear train and speeds of all other gears.	4	L3	2.2.3
10. Classify Bearings and explain with neat sketch the Thrust ball	5	L2	1.3.1

bearings.			
11. Why in a bicycle only chain drive is used and not belt or rope drive? With your own words explain what would have happened if belt or rope drive was used instead?	1	L3	1.3.1

Assignment Questions:

1. Create part models of the components shown in figures	5	L3	5.1.1
2. Create assembly of the parts created in question 12	10	L3	5.1.1

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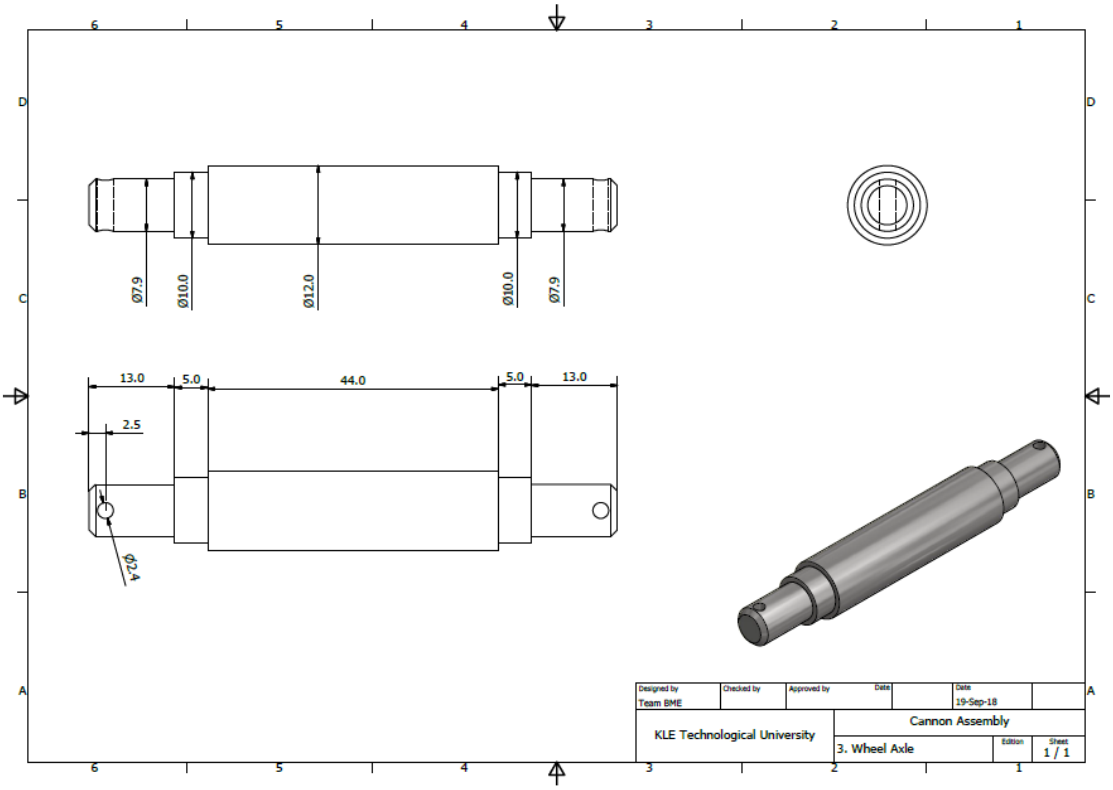
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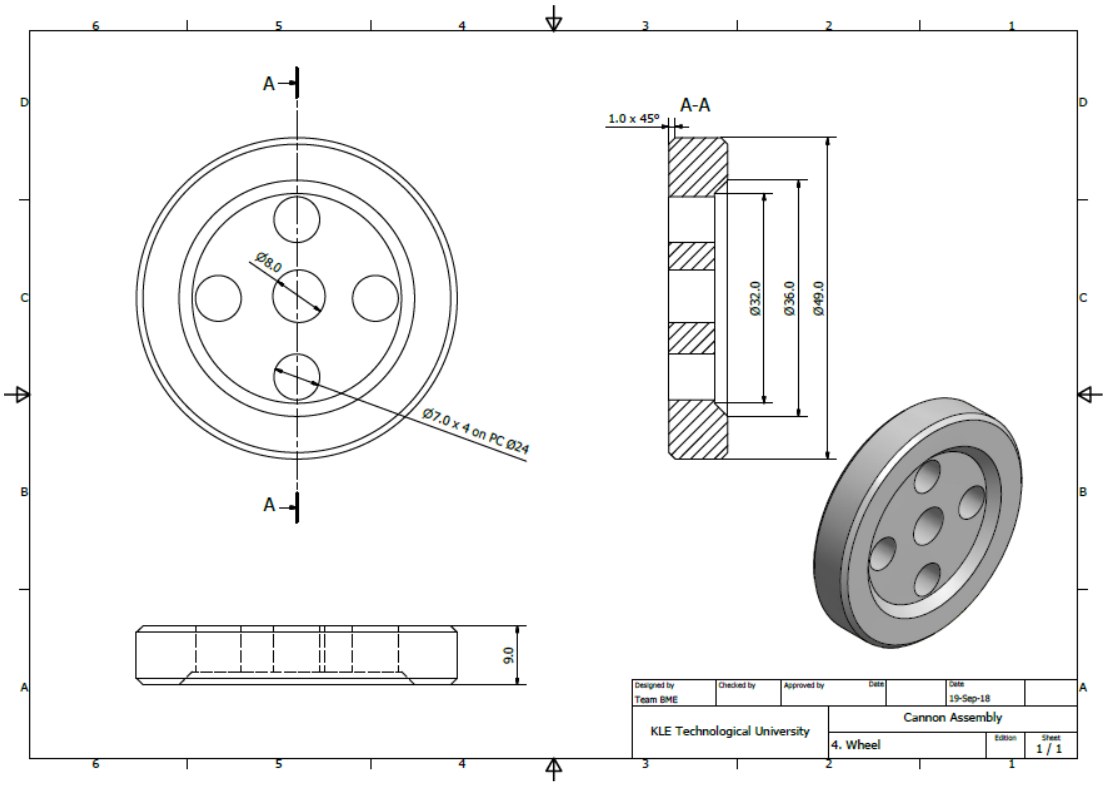
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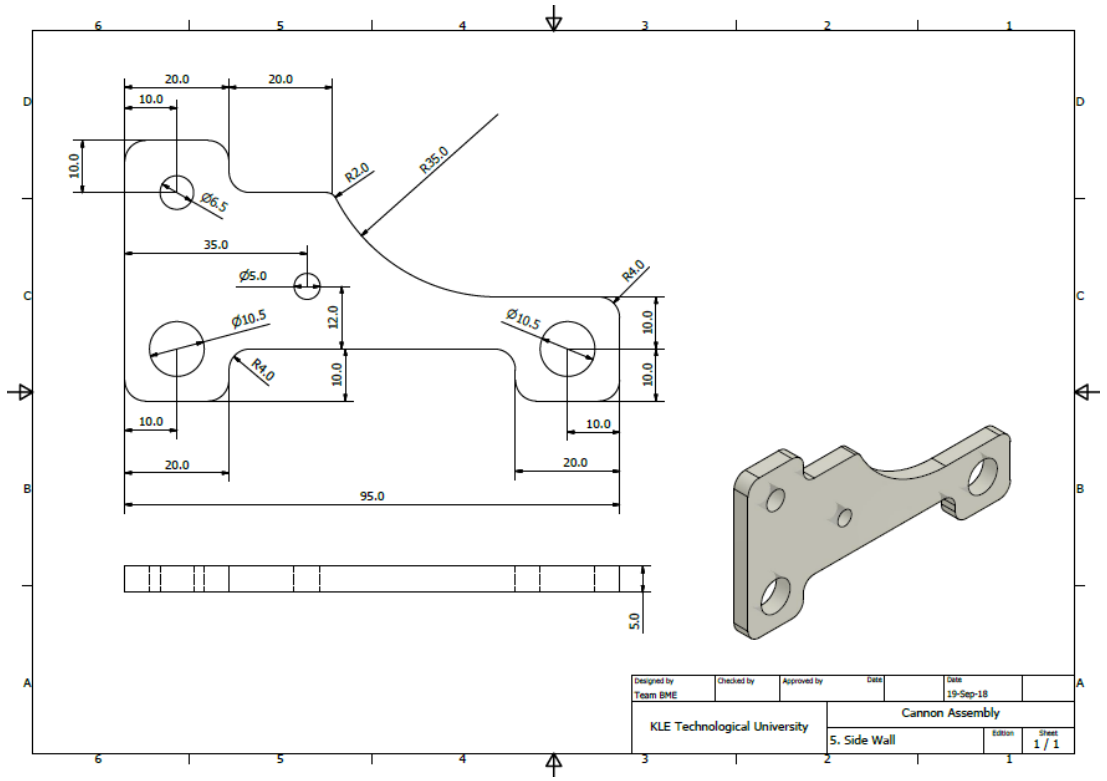
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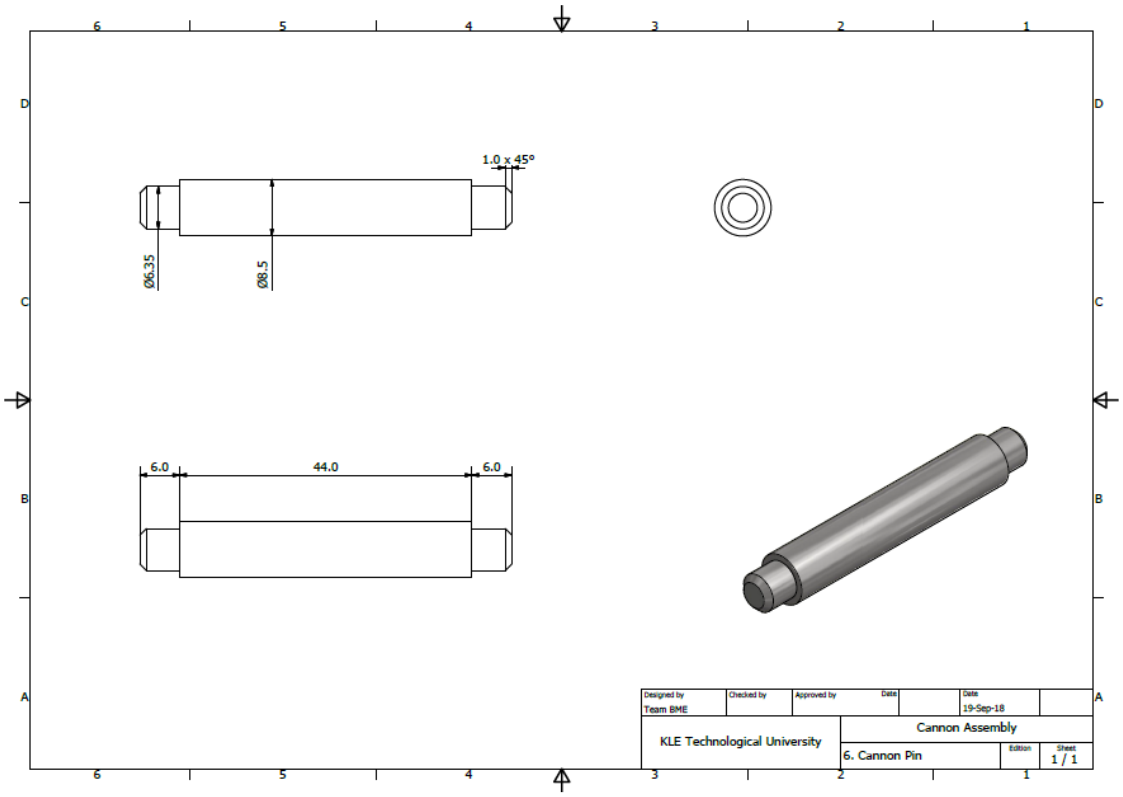
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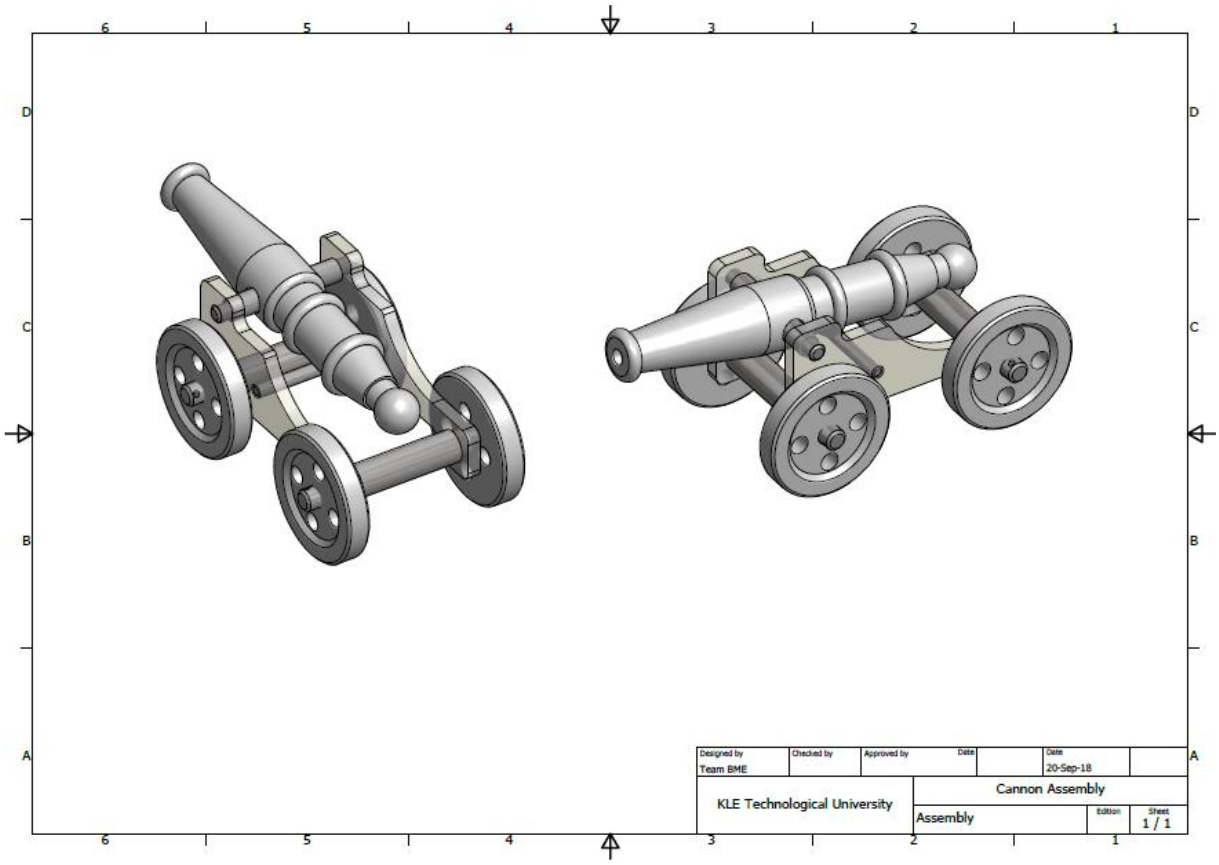

Model post test questions for chapter 2

S.No	Questions	CO	B L	P I
1	The gear used to convert rotary motion into translating motion is A. Worm and wheel B. Crown gear C. Rack and pinion D. Spiral Bevel gear	2	L1	2.2.3
2	Calculate speed of driving shaft in compound gear train, if the drivers have 50, 60, 80 and 100 teeth and followers have 18, 40, 60 and 80 teeth. Speed of driven shaft is 150 rpm. A. 21.73 rpm B. 30.23 rpm C. 19.77 rpm D. None of the above	2	L2	2.1.3

3	The velocity ratio of two pulleys connected by an open belt or crossed belt is A. directly proportional to their diameters B. inversely proportional to their diameters C. directly proportional to the square of their diameters D. inversely proportional to the square of their diameters	2	L1	2.2.3
4	The ratio of tension of two sides of a flat belt is given by A. $e^{-\mu\theta}$ B. $e^{\mu\theta}$ C. e x μ x θ D. None of the above	2	L1	2.2.3
5	The initial tension (T0) in a belt is given by (Where T1=Tension on tight side of belt drive, T2=Tension on slack side of belt drive A. T0 = (T1-T2)/2 B. T0 = (T1+T2)/2 C. T0 = (T1-T2) x 2 D. (T1+T2) x 2	2	L2	2.2.3
6	The effective pulling power of the belt that causes the rotation of the driven pulley is the difference in tensions on the slack and tight sides A. True B. False	2	L2	2.2.3
7	In simple gear train, even number of idler gears will rotate the driven gear in the direction opposite to that of driving gear A. True B. False	2	L1	2.2.3
8	The sum of the diameters of two pulleys A and B connected by a belt is 900 mm. If they run at 700 rpm and 1400 rpm respectively, determine diameter of each pulley A. DA=600 mm, DB=300 mm B. DA=300 mm, DB=600 mm C. DA=700 mm, DB=1400 mm D. none of above	2	L2	2.2.3
9	A_____ bearing supports the load acting along the axis of the shaft. A. Thrust B. Radial C. Longitudinal D. Transversal	2	L1	1.3.1
10	Which of the following are functions of bearings? A. Ensure free rotation of shaft with minimum friction B. Holding shaft in a correct position C. Transmit the force of the shaft to the frame D. All of the listed	2	L1	1.3.1

Course Code and Title: **15EMEF101 / Basic Mechanical Engineering**	
Chapter Number and Title: **3. Manufacturing Engineering: Basics of Manufacturing**	Planned Hours: **5 hrs**

Learning Outcomes:-

At the end of the topic the student should be able to:

Topic Learning Outcomes	COs	BL	CA Code
1. Explain the term 'manufacturing' and importance of different manufacturing processes.	CO2	L3	1.3, 2.1
2. Explain the term of 'scale of production'	CO2	L3	2.1
3. Describe the use of CNC machines for improved productivity and increased flexibility.	CO2	L2	2.1

Lesson Schedule Class No. - Portion covered per hour / per Class
1. What is manufacturing?, Classification of manufacturing Processes
2. Classification of manufacturing Processes contd....
3. Scales of production
4. Advances in Manufacturing: CNC machines

Review Questions

Sl.No. - Questions	TOs	BL	PI Code
1. Explain with neat sketch the kind of process needed for making the predrilled end of a hole into conical shape	1	L3	2.1.3
2. Explain any one appropriate process for the following cases. Case 1. Machine operator reduces the given 50mm diameter round section steel bar to 40 mm diameter. Case 2. To increase the size of Pre-drilled hole on a given material to certain depth. Case 3. To produce	1	L3	2.1.3

the strongest joint between two steel plates.			
3. A labourer is in confusion of selecting the suitable joining process for joining two metal pieces together. The thicknesses of the two metal pieces are 10 mm each and to be lap joined. Explain the kind of joining process needed with justification if the metal pieces are similar (mild steel).If the same labourer is now joining two dissimilar metal sheets of 0.1 mm thickness, suggest the joining process needed.	1	L3	2.1.3
4. What kind of drilling machine will you be interested in to perform the below mentioned scenarios and justify your answer. (a)The work piece is bulky and heavy with size dimensions of 1m x 0.5m x 0.25m. The hole diameter to be drilled is 25mm. (b) The work piece is small in size and not heavy. The size dimensions are 300mm x 50mm x 10mm. (c) The hole diameter to be drilled is 6mm.The work piece cannot be brought to workshop. The size of the hole to be drilled is 5 mm.	1	L3	2.1.3
6. For turning or other general lathe related operations, which one of the below mentioned machine is preferred (for lesser production time and high surface finish) i. Centre lathe machine ii. CNC machine	3	L3	2.1.3
7. Classify the below products based on the scales of production: (1) Nuts and Bolts. (2)Readymade shirts. (3)Fighter Jet planes. (4)Milk Packets. (5)Apartments. (6)Ganesha Idols.	2	L3	2.1.3
8. Explain the classification of manufacturing and give two examples for each of the classification.	1	L2	1.3.1

Model post test questions for chapter 3

S.No	Questions	CO	B L	P I
1	Which manufacturing process includes the powder metallurgy? A. casting B. forming and shaping C. machining D. joining	3	L1	1.3.1
2	Which of the following is not included in forming and shaping process? A. rolling B. forging C. sheet forming D. broaching	3	L1	1.3.1
3	Brazing is a type of metal joining process. A. true B. false	3	L1	1.3.1
4	Which of the following is not the type of joining process? A. adhesive bonding B. brazing C. soldering D. none of the mentioned	3	L1	1.3.1
5	Which of the following is not the advantage of CNC machines? A. Higher flexibility B. Improved quality C. Reduced scrap rate D. Improved strength of the components	3	L1	2.1.3
6	For CNC machining skilled part programmers are needed. A. True B. False	3	L1	2.1.3
7	Which type of surface is produced by turning operation in lathe machine? A. flat B. cylindrical C. taper D. none of the mentioned	3	L1	2.1.3
8	Which of the following operation is carried out to make the hole dimensionally more accurate? A. reaming B. tapping C. boring D. none of mentioned	3	L1	2.1.3

9	Slab milling can be performed more effectively by _____ milling machine. A. horizontal B. vertical C. can't say anything D. none of the mentioned	3	L1	2.1.3
10	Following is (are) the type of cylindrical grinding A. Outside diameter grinding B. Plunge grinding C. Centerless grinding D. All of the above	3	L1	2.1.3

Course Code and Title: **15EMEF101 / Basic Mechanical Engineering**	
Chapter Number and Title: **4. Thermal Engineering 1: Prime movers**	Planned Hours: **7 hrs**

Learning Outcomes:-

At the end of the topic the student should be able to:

Topic Learning Outcomes	COs	BL	CA Code
1. Discuss Steam as a working medium in prime movers and heat engines and its characteristic properties	CO4	L3	2.1
2 Explain the working principle of impulse and reaction steam turbine	CO4	L3	1.3, 2.1
3 Outline the basic operating principles behind two-stroke and four-stroke internal combustion engines.	CO4	L3	1.3, 2.1

Lesson Schedule Class No. - Portion covered per hour / per Class
1. Steam- Formation of steam, Properties of steam
2. Applications of steam, Steam turbines: Working principle of impulse and reaction steam turbines
3. Introduction, classification and parts of an IC Engine
4. Working principle of 4 stroke petrol and diesel Engine
5. Working principle of 2 stroke petrol and diesel Engine
6. Comparison of 2 stroke and 4 stroke engine, Comparison of diesel and petrol engine
7. Numerical problems on engine performance

Review Questions

Sl.No. - Questions	TOs	BL	PI Code
1. Superheated steam condition is to be achieved beginning with water. Explain the condition with suitable sketches.	1	L2	1.3.1

2. In a boiler at a thermal power station, at certain pressure, it contains some amount of water and some amount of steam. Explain about the state of the steam present in boiler.	1	L2	1.3.1
3. A cloth manufacturing industry is in need of a steam turbine. The turbine should be able to produce very high revolutions up to around 20000 rpm. Suggest and explain with neat sketch the suitable type of turbine needed.	2	L3	2.1.3
4. Give the classification of IC engines based on type of ignition, no of cylinders and position of cylinders	3	L2	1.3.1
5. A person is driving a car which liberates lot of smoke and there is annoying sound of the engine, the mileage of the engine is also very less. But it has very good pickup and engine is powerful. Explain the working principle of this particular engine which is running on petrol.	3	L3	2.1.3
6. Explain the working principle of 4 stroke petrol engine with the help of PV diagram.	3	L2	2.1.3
7. Ramu wants to participate in the next upcoming state level bike racing competition. You being the technical consultant for him suggest and explain with neat sketch the kind of engine needed for the race which runs on petrol.	3	L3	2.1.3
8. Sketch and explain the working principle of 4 stroke diesel engine	3	L2	1.3.1
9. A heavy duty truck has a piston diameter 250 mm and stroke 400 mm. The mean effective pressure is 4 bar and the speed is 500 rpm. The diameter of the brake drum is 1m and the effective brake load is 400 N. Find indicated power, brake power and friction power. Assume mileage of the truck is a special concern.	3	L3	2.2.3
10. The following readings were taken on a 4 cylinder petrol engine. Diameter of the brake drum = 1.5 m. Diameter of the rope = 10 mm. Load suspended on the brake drum = 100 kg. Spring balance reading = 5 kg. Crankshaft speed = 200 rpm. Determine the brake power of the engine.	3	L3	1.3.1

Model post test questions for chapter 4

S.No	Questions	CO	B L	P I
1	Mixture of steam and liquid water is called as _____ A. dry steam B. wet steam C. saturated steam D. none of the mentioned	4	L1	2.1.3
2	Which of the following is not a type of steam turbine? A. Impulse turbine B. Reaction turbine C. Pelton wheel turbine D. Axial flow type turbine	4	L1	2.1.3
3	Which statement about impulse turbine is true? A. Steam expands over blades B. Steam expends completely in stationary nozzles C. Steam expends partially over nozzle and turbine blades D. Steam expends over blades incompletely	4	L1	2.1.3
4	The diesel engines are also known as _____ engines A. compression ignition B. spark ignition	4	L1	2.1.3
5	In a diesel engine, the fuel is ignited by A. spark B. injected fuel C. heat resulting from compressing air that is supplied for combustion D. ignition	4	L1	2.1.3
6	Scavenging air in diesel engine means A. air used for combustion sent under pres-sure B. forced air for cooling cylinder C. burnt air containing products of combustion D. air used for forcing burnt gases out of engine's cylinder during the exhaust period	4	L1	2.1.3
7	Which of the following is not an interns combustion engine A. 2-stroke petrol engine B. 4-stroke petrol engine C. diesel engine D. steam turbine.	4	L1	2.1.3
8	The air-fuel ratio of the petrol engine is controlled by (a) fuel pump (b) governor (c) injector (d) carburettor	4	L1	1.3.1

9	The following data was recorded during testing of a TWO STROKE petrol engine: Diameter of the piston d= 150 mm Stroke length L= 180 mm RPM of the engine N = 300 Indicated mean effective pressure pm= 6.1 bars The Indicated power in Watts is A.9000 W B.9700 W C.6000 W D.6700 W	4	L2	1.3.1
10	Indicated power of a 4-stroke engine is equal to where p = mean effective pressure, L = stroke A = area of piston and N = rpm of engine A. pLAN B. 2pLAN C. pLAN/2 D. 4pLAN	4	L2	1.3.1

Course Code and Title: **15EMEF101 / Basic Mechanical Engineering**	
Chapter Number and Title: **5. Thermal Engineering 2: Thermal Systems Applications**	Planned Hours: **4 hrs**

Learning Outcomes:-

At the end of the topic the student should be able to:

Topic Learning Outcomes	COs	BL	CA Code
1. Explain the working principle of Refrigeration system	CO5	L3	1.3, 2.1
2 Describe the working principle of Air conditioning system	CO5	L3	2.1
3 Outline the working of a pump & blower	CO5	L3	2.1
4 Describe the functioning of an air compressor	CO5	L3	2.1

Lesson Schedule Class No. - Portion covered per hour / per Class
1. Refrigeration: Definition, Principle of Refrigeration, VCR,Refrigerant, Refrigeration concept, parts of Refrigerator
2. Air conditioner: Working principle of an air conditioner
3. Pumps and Blowers: Working principle of a pump and blower
4. Working principle of an air compressor

Review Questions

Sl.No. - Questions	TOs	BL	PI Code
1. Describe the working principle of a refrigerator with a neat sketch	1	L2	1.3.1
2. Raju wants to fill overhead tank with water. He uses a machine which would help in lifting the water from underground tank to overhead tank. Suggest the suitable machine and explain its working principle with the help of a neat sketch	3	L2	1.3.1
3. Suggest and explain a suitable pump for the below mentioned scenario	3	L3	2.1.3

a)High air flow and low pressure rise b)Low air flow and high pressure rise			
4. There is a need to maintain the temperature of medicines at 0° C irrespective of atmospheric temperature. Suggest and explain the best device for this situation	1	L3	2.1.3
5. With a neat sketch explain the working of Vapour Compression refrigeration system.	1	L2	1.3.1
6. Explain the thermodynamic properties of an ideal refrigerant	1	L2	1.3.1
7. With a neat sketch explain the working principle of Centrifugal air compressor.	4	L2	1.3.1
8. Hot air blower is used in a foundry to enhance the burning capacity of the furnace. Explain the basis on which the blower works with the help of a sketch.	3	L2	2.1.3
9. Explain the properties of an ideal refrigerant	1	L2	1.3.1
10. An industry generates waste which is highly viscous slurry. Suggest a suitable machine needed to pump the slurry to waste carrying tankers.	3	L3	2.1.3

Model post test questions for chapter 5

S.No	Questions	CO	B L	P I
1	During which component of vapour compression refrigeration system, the enthalpy remains constant: A. Evaporator B. Compressor C. Throttle valve D. None	5	L1	1.3.1
2	Commonly used refrigerant in commercial ice plant is A. CO2 B. Freon 12 C. Ammonia D. Air	5	L1	1.3.1
3	Freon group of refrigerants are A. Inflammable B. Toxic C. Non-inflammable and toxic D. Nontoxic and non-inflammable	5	L1	1.3.1

4	In mechanical refrigeration system, the refrigerator has the maximum temperature A. In evaporator B. Before Expansion Valve C. Between Compressor and Condenser D. Between Condenser and evaporator	5	L1	1.3.1
5	In vapour compression cycle, the condition of refrigerant is saturated liquid A. after passing through the condenser B. before passing through the condenser C. after passing through the expansion throttle valve D. before entering the expansion valve	5	L1	1.3.1
6	Which of the following is not a component of packaged air conditioners? A. Compressor B. Condenser C. Chiller D. Evaporator	5	L1	1.3.1
7	The main function of centrifugal pumps are to _____ A. Transfer speed B. Transfer pressure C. Transfer temperature D. Transfer energy	5	L1	2.1.3
8	Centrifugal pumps transfer energy from _____ A. Rotor to fluid B. Fluid to rotor C. Draft to rotor D. Rotor to draft	5	L1	2.1.3
9	What is the purpose of the blower? A. Decrease air flow B. Increase air flow C. Create vacuum D. Maintain air flow	5	L1	2.1.3
10	Centrifugal compressors are also known as _____ A. turbo compressors B. radial compressors C. turbo & radial compressors D. none of the mentioned	5	L1	2.1.3

Question Paper Title: Model Question Paper for ISA I		
Total Duration (H:M):1:15	**Course :Basic Mechanical Engineering (15EMEF101)**	**Maximum Marks :40**
Note : Answer any TWO full questions		

Q.No.	Questions	Marks	CO	BL	PO	PI Code
1a	Classify the branches of mechanical engineering.	5	CO1	L2	1	1.3.1
1b	Suggest and explain a suitable power transmission drive used in a lathe machine to turn a railway wagon wheel.	5	CO2	L3	2	2.1.3
1c	In a belt transmission system the driven pulley is of diameter 400 mm and driver pulley of diameter 700 mm respectively. Driven pulley runs at a speed of 200 rpm. The angle of lap on driven and driver pulley are 165° and 200°. The coefficient of friction between the belt and pulley is 0.25. Find the power transmitted if the initial tension is not to exceed 10 kN. Also find the speed of the driver pulley and velocity ratio of the system.	10	CO2	L3	2	2.1.3
2a	Explain the working of Helical gear with a neat sketch	5	CO2	L3	2	2.1.3
2b	Consider a pulley ‘A’ as driver and ‘B’ as driven pulley of bore well drilling machine. (i) Direction of the pulley ‘B’ must rotate opposite to that of ‘A’ when the drilling is under progress into the ground. (ii)While retracting the drill from the ground the pulley ‘B’ must rotate in the same direction of ‘A’. Suggest suitable belt drives for both the cases.	5	CO2	L3	2	2.1.3
2c	Briefly explain any five achievements of mechanical engineering.	10	CO1	L2	1	1.3.1
3a	Write the flowchart of manufacturing process of pressure cooker	5	CO1	L1	2	1.3.1
3b	Differentiate between open and crossed belt drives	5	CO2	L2	1	1.3.1
3c	A leather belt is mounted on two pulleys. The larger	10	CO2	L3	2	2.1.3

	pulley has diameter equal to 1.2 m and rotates at speed equal to 25 rad/s. The angle of lap is 150°. The maximum permissible tension in the belt is 1200 N. The coefficient of friction between the belt and pulley is 0.25. Determine the maximum power which can be transmitted by the belt if initial tension in the belt lies between 800 N and 960 N.					

Question Paper Title: Model Question Paper for ISA II		
Total Duration (H:M):1:15	**Course :Basic Mechanical Engineering (15EMEF101)**	**Maximum Marks :40**
Note :Answer any TWO full questions		

Q.No.	Questions	Marks	CO	BL	PI Code
1a	A dove tail key way is to be milled in a machine component. Explain with neat sketch the suitable process needed.	5	CO3	L3	2.1.3
1b	With a temperature enthalpy diagram explain the formation of steam at constant pressure	5	CO4	L2	1.3.1
1c	Explain the three scales of production with production layout diagram	10	CO3	L2	2.2.3
2a	An entrepreneur is interested in setting up a new nut and bolt manufacturing industry. The expected batch production is 1000 products per day. But he is in a dilemma whether to purchase a conventional lathe or a CNC lathe. You being a consultant suggest and justify suitable option.	5	CO3	L2	1.3.1
2b	A high speed race bike has a piston diameter 40 mm and stroke 100 mm. The mean effective pressure is 4 bar and the speed is 2500 rpm. The diameter of the brake drum is 1m and the effective brake load is 400 N. Find indicated power, brake power and friction power. Assume that mileage of the bike is not a concern; however the bike should have high pick up and power.	5	CO4	L3	2.2.3
2c	A single cylinder four stroke engine runs at 1000 rpm and has a bore of 115 mm and a stroke of 140 mm. The brake load is 6 kg at 0.6 m radius and the mechanical efficiency is 80 %. Calculate the brake power and mean effective pressure.	10	CO4	L2	2.1.3

3a	In a machine component, a screw will be inserted in a hole. The screw head is conical shape. Some provision is to be made on the machine component so that the screw top surface will be in flush with the machine component surface. Explain with neat sketch the suitable process needed.	5	CO3	L3	2.1.3
3b	For the same machine component that in the above question, instead of screw, a bolt is being inserted. Some provision is to be made for accommodating the bolt head into the machine component so that the bolt head top surface will be in flush with the machine component. Suggest and explain the kind of suitable process needed.	5	CO3	L3	2.1.3
3c	Explain the working of 4 stroke petrol engine with a neat sketch	10	CO4	L2	2.1.3

Question Paper Title: Model Question Paper for ESA		
Total Duration (H:M):3:00	**Course :Basic Mechanical Engineering (15EMEF101)**	**Maximum Marks :100**
Note :Answer any two questions from unit I and unit II and any one question from unit III		

Unit - I						
Q.No.	**Questions**	**Marks**	**CO**	**BL**	**PO**	**PI Code**
1a	Show the expression for ratio of tensions. With neat sketch explain the different terminologies used.	5	CO2	L2	1	1.3.1
1b	Identify and explain the kind of gear which converts rotary motion into linear motion in a machine	5	CO2	L2	1	1.3.1
1c	With a flowchart explain the manufacturing process of Pressure cooker.	10	CO1	L3	2	2.1.3
2a	Explain with a neat sketch working of worm gear	5	CO2	L3	2	2.1.3
2b	Differentiate between open and crossed belt drives	5	CO1	L2	2	2.1.3
2c	The driven pulley of 400 mm diameter of a belt drive runs at 200 rpm.The angle of lap is 165° and the coefficient of friction between the belt and pulley is 0.25. Find the power transmitted if the initial tension is not to exceed 10 kN	10	CO2	L3	1	1.3.1
3a	Suggest and explain with a neat sketch the type of roller bearing used to withstand both radial and thrust loads	5	CO2	L3	2	2.1.3
3b	There is a need for an output shaft which has uniformly varying speed. This shaft is to be connected to a motor which runs at constant speed. Suggest and explain a suitable gear drive needed to achieve the above objective.	5	CO2	L3	2	2.1.3

3c	Mechanical engineers have contributed a lot to society. Brief on any five contributions of Mechanical Engineers.	10	CO2	L2	1	1.3.1

Unit - II

Q.No.	Questions	Marks	CO	BL	PO	PI Code
4a	A permanent joint is to be produced between two metal pieces. Suggest the suitable joining process and explain it working with a sketch.	5	CO3	L3	2	2.1.3
4b	Differentiate between welding and brazing	5	CO3	L3	2	2.1.3
4c	A mechanic intends to reduce the diameter of a round bar precisely by few mm. Identify and explain the suitable process which can be performed on lathe machine to achieve the above mentioned task.	10	CO3	L2	1	1.3.1
5a	Give the classification of IC engines based on type of ignition, no of cylinders and position of cylinders	5	CO4	L2	1	1.3.1
5b	Explain the formation of steam at constant pressure	5	CO4	L2	2	2.1.3
5c	Explain the working of 4 stroke diesel engine with a neat sketch and thermodynamic graph.	10	CO4	L3	1	2.1.3
6a	With a block diagram explain the working of CNC machine	5	CO4	L2	1	1.3.1
6b	Find the indicated power of a four stroke petrol engine of swept volume of 6 litres and running at 1000 rpm. The mean effective pressure is 600 kN/m^2	5	CO4	L2	2	2.1.3
6c	A thermal power plant is planning to purchase a new turbine. The turbine should produce high rotor speeds. Suggest and explain the working of turbine needed with neat sketch and pressure	10	CO4	L3	2	2.1.3

	velocity diagram.					
Unit - III						
Q.No.	**Questions**	**Marks**	**CO**	**BL**	**PO**	**PI Code**
7a	Explain the working of Vapour Compression Refrigeration system.	10	CO5	L2	1	1.3.1
7b	There is extreme hot climate and it is impossible to bear the heat. A device will help to considerably give comfort to the people by reducing the inside temperature. Suggest and explain the suitable device needed with a neat sketch.	10	CO5	L3	2	2.1.3
8a	A balloon is to be inflated so that the correct air pressure is maintained. Explain with neat sketch the working of the machine which is used to inflate the balloon.	10	CO5	L3	2	2.1.3
8b	Explain the working of Centrifugal pump with a sketch	10	CO5	L2	2	2.1.3