Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Sem & AY: Odd Sem 2019-20 | **Date**: 30.09.2019

Course Code: MEC 101 | **Time**: 9.30 AM to 10.30 AM

Course Name: Elements of Mechanical Engineering | **Max Marks**: 30

Program & Sem: B.Tech (Chemistry Cycle) & I | **Weightage**: 15%

Instructions:

(i) Read the questions properly and answer accordingly.

(ii) Question Paper consists of 3 Parts.

(iii) Scientific and non-programmable calculators are permitted.

Part A [Memory Recall Question]

Answer all the Questions. Each Question carries five marks. (3Qx5M=15M)

1. Differentiate between renewable and non-renewable sources of energy with examples. (CO.NO.1) [Knowledge]
2. State all laws of thermodynamics. (CO.NO.1) [Knowledge]
3. Define Refrigeration effect and COP of the system. Also, define one ton of refrigeration. (CO.NO.1) [Knowledge]

Part B [Thought Provoking Question]

Answer both the Questions. Each Question carries three and half marks. (2Qx3.5M=7M)

4. Suppose we have an ice cube at $0^{O}C$ and heat energy at constant pressure is being supplied to convert it into steam of 150 ^{O}C. Draw Temperature-Enthalpy line diagram for this process and clearly mention all the process. (CO.NO.1) [Comprehension]
5. Write the type of system for the following cases with definition.
   (a) A packed cold-drink can.
   (b) When you are boiling soup in a open saucepan on a stove.
   (c) Assume this universe as your system.

   (CO.NO.1) [Comprehension]

Part C [Problem solving Questions]

Answer both the Questions. Each Question carries four marks. (2Qx4M=8M)

6. Convert the following units
   (a) 205 ^{O}C into ^{O}F and K.
   (b) 1760 mm Hg absolute into kPa. (CO.NO.1) [Application]

7. A refrigeration system absorbs heat at a rate of 240 kW, while its compressor consumes a power of 80 kW. Calculate COP of the system and heat rejected from the system? (CO.NO.1) [Application]

SCHOOL OF ENGINEERING

Semester: Odd Semester
Course Code: MEC 101
Course Name : Elements of Mechanical Engineering
Program & Sem: B.Tech and I semester

Date: 30 September 2019
Time: 1 Hour
Max Marks: 30
Weightage: 15%

Extract of question distribution

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
		Module 1	K	C	A	
1.	1	Energy Resources	K			5
2	1	Thermodynamics	K			5
3.	1	RAC	K			5
4.	1	Steam		K		3.5
5.	1	Thermodynamics		K		3.5
6.	1	Energy Resources			K	4
7.	1	RAC			K	4
	Total Marks	30				30

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

[I hereby certify that All the questions are set as per the above guide lines. Mr. Narender Singh]

Reviewers' Comments

Annexure- II: Answer Scheme

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Semester: I
Course Code: MEC 101
Course Name : Elements of Mechanical Engineering
Program & Sem: B.Tech and I semester

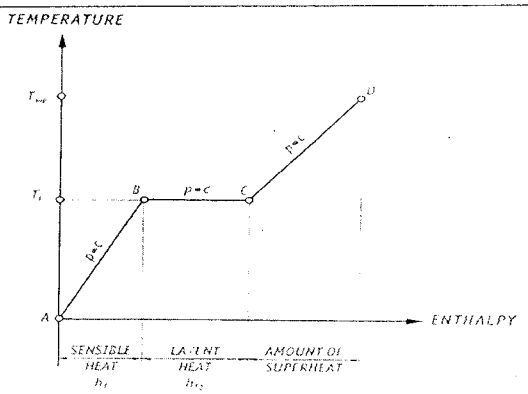
Date: 30 September 2019
Time: 1 Hour
Max Marks: 30
Weightage: 15%

Part A (3Q x 5M = 15 Marks)

<table>
<tr><th>Q No</th><th>Solution</th><th>Scheme of Marking</th><th>Max. Time required for each Question</th></tr>
<tr><td>1.</td><td>
<table>
<tr><th>S.No.</th><th>Renewable</th><th>Non-renewable</th></tr>
<tr><td>1.</td><td>Inexhaustible
Ex: Solar Energy, Wind Energy</td><td>Exhaustible
Ex: Petroleum, Coal, Natural Gas</td></tr>
<tr><td>2.</td><td>Environment Friendly</td><td>Not Environment Friendly</td></tr>
<tr><td>3.</td><td>Freely available in nature</td><td>Not freely available in nature</td></tr>
<tr><td>4.</td><td>Maintenance cost is low</td><td>Maintenance cost is high</td></tr>
<tr><td>5.</td><td>Continuous supply of energy is not possible</td><td>Continuous supply of energy is possible with non renewable energy sources</td></tr>
</table>
</td><td>Each point carries 1 Marks</td><td>8 min</td></tr>
<tr><td>2.</td><td>Zeroth law of thermodynamics states that "the bodies A and B are in thermal equilibrium with a third body C separately then the</td><td>Each definition</td><td>10 min</td></tr>
</table>

	two bodies A and B shall also be in thermal equilibrium with each other". **First law of the Thermodynamics** is the application of the conservation of energy principle. Energy Conservation states that energy can neither be created nor destroyed. **Second Law of Thermodynamics** **Kelvin-Planck's Statement** It is impossible for any device that operates on a cycle to receive heat from a single reservoir and produce a net amount of work. **Clausius Statement** It is impossible to construct a device that operates in a cycle and produces no effect other than the transfer of heat from a lower-temperature body to a higher-temperature body. **Third Law of Thermodynamics** It states, "The entropy of a perfect crystal is zero when the temperature of the crystal is equal to absolute zero (0 K).	carries 1 marks	
3.	**Refrigeration Effect**- It is the amount of heat which is required to extract in order to provide and maintain the lower temperature than that of the surrounding. **COP of the system**: The coefficient of performance (COP) of a refrigeration system is defined as the ratio of the refrigerating effect (heat absorbed) to the work supplied. **One ton of refrigeration** : *A ton of refrigeration* is defined as the amount of heat which is required to extract from 1 tonne of water at 0^0C in order to convert it into equivalent ice at 0^0C in a day (or 24 hrs) .	2,1,2 Marks	5 min

Part B (2Q x 3.5M = 7 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4.	 Temperature-Enthalpy Diagram	Diagram 2.5 Marks. Marking in diagram with all temperature- 1Mark	5 min
5.	(a) Closed System: The system in which only energy (not the matter/mass) crosses the boundaries of the system.	Identification- 2 Marks	5 min

	(b) Open System: The system in which both energy and matter (mass) cross the boundaries of the system. (c) Isolated System: The system in which neither energy nor matter (mass) cross the boundaries of the system.	Definition 1.5 Marks	

Part C (2Q x 4M = 8 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6.	6(a) 205°C $F_2 = \frac{9}{5} C + 32$ $= \frac{9}{5} \times 205 + 32$ $F_2 = 401°F$ $K_2 = 205°C + 273.15$ $= 478.15K$ (b) 1760 mm Hg We know, 760 mm of Hg = 101.325 kPa 1 mm of Hg = $\frac{101.325}{760}$ kPa 1760 mm of Hg = $\frac{101.325 \times 1760}{760}$ kPa = 234.65 kPa	Each part carries 2 Marks	10 min
7.	$Q_s = 240$ kW $W = 80$ kW $COP = \frac{240}{80} = 3$ We know, $Q_R = Q_s + W$ $= 240 + 80$ $Q_R = 320$ kW	COP -2 Marks Qr- 2 Marks	5 min

Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 2

Sem & AY: Odd Sem 2019-2020 | **Date**: 18.11.2019

Course Code: MEC 101 | **Time**: 9.30 AM to 10.30 AM

Course Name: ELEMENTS OF MECHANICAL ENGINEERING | **Max Marks**: 30

Program & Sem: B.Tech. (Chemistry Cycle) & I Sem | **Weightage**: 15%

Instructions:

(i) Read the questions properly and answer accordingly.

(ii) Question paper consist of 3 Parts A, B & C.

(iii) Scientific and non-programmable Calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries five marks. (3Qx5M=15M)

1. State the difference between Spark ignition engine and Compression ignition engine. (C.O.NO.1)[Knowledge]
2. Define Mean effective pressure and compression ratio. Also mention the range of compression ratio in petrol and diesel engine. (C.O.NO.1)[Knowledge]
3. What is transmission system? List the factors to be considered for selecting transmission system? (C.O.NO.2)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries three marks. (2Qx3M=6M)

4. Identify the type of turbine using the following parameters.
   a) A high head, tangential flow and impulse turbine.
   b) Low head, axial flow and reaction turbine.
   c) Medium head, radial flow and reaction turbine. (C.O.NO.1)[Comprehension]

5. Describe the condition of axes positions of driver and driven shaft for the following types of gears.
   a) Spur gear
   b) Rack & pinion and
   c) Worm gears (C.O.NO.2)[Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries four and half marks.
(2Qx4.5M=9M)

6. A single cylinder 4-stroke IC engine has a bore of 180mm, stroke of 200mm and a rated speed of 300 rpm. Torque on the brake drum is 200Nm and mean effective pressure is 6 bar. It consumes 4 kg of fuel in one hour. The calorific value of the fuel is 42000 kJ/kg. Determine (i) Brake power (ii) Indicated power (iii) Brake thermal efficiency. (C.O.NO.1) [Application]
7. Calculate the power transmitted by driving gear to driven gear, when it transmits 120 N-m of torque to driven gear and when driving gear rotates with 100 RPM. (C.O.NO.2) [Application]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: Odd Sem 2019-20

Course Code: MEC 101

Course Name: **Elements of Mechanical Engineering**

Date: 18.11.2019

Time: 9.30-10.30 AM

Max Marks: 30

Weightage: 15%

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO (%age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1.	1	IC Engines	5			5
2.	1	IC Engines	5			5
3.	2	Transmission system	5			5
4.	1	Turbines		3		3
5.	2	Transmission system		3		3
6.	1	IC Engines			4.5	4.5
7.	2	Transmission system			4.5	4.5
	Total Marks		15	6	9	30

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines. [Name of faculty]

Reviewer's Comments:

Annexure- II: Format of Answer Scheme

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Semester: I

Course Code: ME 101

Course Name: Elements of Mechanical Engineering

Date: 18.11.2019

Time: 1Hour

Max Marks: 30

Weightage: 15 %

Part A (3Q x 5M =15 Marks)

<table>
<tr><th>Q No</th><th>Solution</th><th>Scheme of Marking</th><th>Max. Time required for each Question</th></tr>
<tr><td>1.</td><td>
<table>
<tr><th>S.No</th><th>S I Engine</th><th>C I Engine</th></tr>
<tr><td>1</td><td>Draws mixture of air and petrol during suction stroke</td><td>Draws only air during suction stroke</td></tr>
<tr><td>2</td><td>At the end of compression stroke spark is produced</td><td>At the end of compression stroke Fuel is injected</td></tr>
<tr><td>3</td><td>It works on the principle of Otto Cycle</td><td>It works on the principle of Diesel Cycle</td></tr>
</table>
</td><td>Each point carries 1 mark</td><td>10 min</td></tr>
</table>

	4	Combustion of fuel takes place at constant volume process	Combustion of fuel takes place at constant pressure process		
	5	Power developed is less	Power developed is more		
2.	Mean effective pressure is the average pressure acting on the piston during power stroke Work Done = Pm * Vs Where Vs = Stroke Volume Compression ratio is the ratio of total volume of cylinder to clearance volume Compression ratio = $(V_S + V_C)/ V_C$ Range of compression ratio in petrol engine is 6 to 8 Range of compression ratio in petrol engine is 12 to 24			**2 marks** **2 marks** **1 Marks**	**8 min**
3.	The system that is used to transmit mechanical power from one mechanical element to another. 1. Distance between driver and driven shaft. 2. Operational speed. 3. Power to be transmitted			**2 Marks** **3 Marks**	**5 min**

Part B **(2Q x 3M = 6 Marks)**

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4.	(a) Pelton wheel turbine (b) Kaplan turbine (c) Fransis turbine	Each 1 marks	6 min
5.	**Spur gear** Spur gears or straight-cut gears are the simplest type of gear. Transmitting torque between parallel shafts. The edge of each tooth is straight and aligned parallel to the axis of rotation. **Rack and Pinion Gear** The rack and pinion gear is used to convert between rotary and linear motion.	1 marks 1 marks	6min

	WORM GEAR These gears are used for transmitting motion between non parallel and non intersecting shafts. Worm gear mostly used when speed ratio is quiet high.	1 marks	

Part C **(2Q x4.5 M = 9 Marks)**

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6.	(i) Brake power $BP = \frac{2\pi NT}{60 \cdot 1000}$ kW $BP = \frac{2\pi \cdot 300 \cdot 200}{60 \cdot 1000}$ $BP = 6.28$ kW	1.5 Mark	10 min
	(ii) Indicated Power $IP = nP_m LANK\left(\frac{10}{6}\right)$ kW $IP = 1 \cdot 6 \cdot 0.2 \cdot 0.0254 \cdot 300 \cdot \frac{1}{2}\left(\frac{10}{6}\right)$ kW $IP = 7.63$ kW	1.5 Mark	
	(iii) Brake thermal efficiency $\eta_{B_{th}} = \frac{BP}{m_f \cdot CV} \cdot 100$ $\eta_{B_{th}} = \frac{6.28}{1.11 \cdot 10^{-3} \cdot 42000} \cdot 100$ $\eta_{B_{th}} = 13.47\%$	1.5 Mark	
7.	Torque 120 N m Speed N=100 RPM Power P=T ω Angular Velocity $\omega = 2\pi N/60 = 2*3.14*100/60 = 10.46$ Rad/s Power= $T*\omega = 120*10.467 = 1256$ W = 1.256 KW	2.5 Mark 2 Mark	6 min

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20 | **Date**: 30 December 2019

Course Code: MEC 101 | **Time**: 1.00 PM to 4.00 PM

Course Name: ELEMENTS OF MECHANICAL ENGINEERING | **Max Marks**: 100

Program & Sem: B.Tech (Chemistry Cycle) & I | **Weightage**: 50%

Instructions:

(i) Read the all questions carefully and answer accordingly.

(ii) Programmable calculators are not allowed.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 5 marks. **(8Qx5M=40M)**

1. Define pressure and explain types of pressure with neat sketch (C.O.No.1) [Knowledge]

2. State Zeroth law, first law and second law of thermodynamics and give the equation.

(C.O.No.1) [Knowledge]

3. Differentiate between Up milling and Down milling (C.O.No.3) [Knowledge]

4. Differentiate between open and cross belt drive. (C.O.No.2) [Knowledge]

5. Explain the properties of engineering materials (C.O.No.4) [Knowledge]

6. Describe the following drilling operations with neat sketch:

a) Counter boring b) Reaming (C.O.No.3) [Knowledge]

7. Differentiate between Two stroke and Four Stroke Engine. (C.O.No.1) [Knowledge]

8. Define refrigeration and explain the basic principle of refrigeration with the neat sketch

(C.O.No.1) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 12 marks. **(3Qx12M=36M)**

9. a) Name the Engine which sucks only air during suction stroke and also explain its working principle with neat sketch (Only strokes) [8M]

b) Sketch & label Electric Arc Welding process [4M]

explain [6M]

(C.O.No.3&4) [Comprehension]

11. a) List types of Gears and explain any 2 types with neat sketches.

b) Give the example for the following:

i) High Head turbine

ii) Medium Head turbine

iii) Low Head turbine

iv) Open system

v) Closed system

vi) Isolated system (C.O.No1&2) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 12 marks. (2Qx12M=24M)

12. a) A 4-stroke engine has a piston diameter 250mm and stroke 400mm. The mean effective pressure is 4 bar and speed is 500 rpm. The diameter of the brake drum is 1000mm and the effective brake load is 400N. Find the indicated power, brake power and friction power.

[8M] (C.O.No.1) [Application]

b) Calculate the power transmitted between belt and pulley if the Tension at tight side is 80 N and Tension at the slack side is 40 N and velocity of the belt is 10 m/s.

[4M] (C.O.No.2) [Application]

13. a) Covert the following:

i) 500 bar into Pascal

ii) 200^0C into Fahrenheit

iii) 350 Fahrenheit to Kelvin

[6M] (C.O.No.1) [Application]

b) A 4 cylinder 4-stroke engine running at 1000rpm develops an indicated power of 15 kW. The mean effective pressure is $5x10^5$ N/m^2. Find the diameter of the cylinder and the stroke

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF Engineering

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
PART A Q. NO1 Q.NO2 Q.NO3 Q.NO4 Q.NO5 Q.NO6 Q.NO7 Q.NO8	CO 01 CO 02 CO 03 CO 04 CO 05	All the 5 modules	40 [5+5+5+5+5+5+5+5]			40
PART B Q. NO 9	CO 02 & 5	MODULE 02 & 05 Prime Movers & Manufacturing Processes	-	12	-	12
PART B Q.NO10	CO 04 & 5	MODULE04 & 05	-	12	-	12

		Materials & Manufacturing Processes				
PART B Q.NO11	CO 01 & 02	MODULE 01.02 & 03 Thermal Engineering Prime Movers & Transmission Drives	-	12	-	12
PART C Q.NO12	CO 01 & 02	MODULE 02 & 03 Prime Movers & Transmission Drives	-		12	12
PART C Q.NO13	CO 01	MODULE 01 & 02 Thermal Engineering Prime Movers	-		12	12
	Total Marks		40	36	24	

K =Knowledge Level C = Comprehension Level, A = Application Level

C.O WISE MARKS DISTRIBUTION:

CO 01: 52 MARKS, CO 02: 15 MARKS, CO 03: 16 MARKS, CO 04:17 MARKS

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must

be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

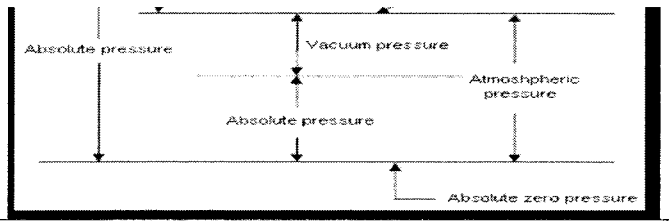
GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

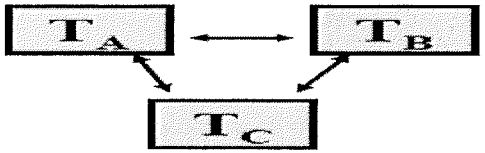
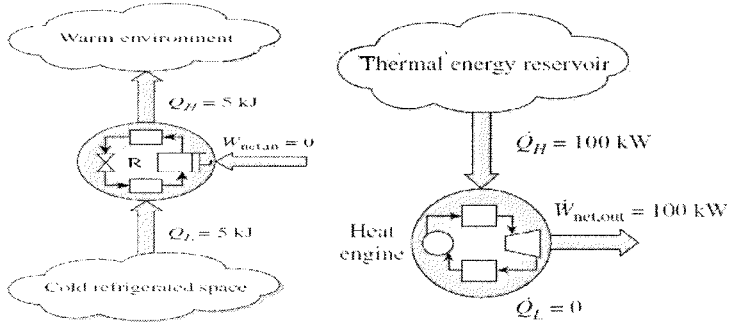
Semester: Odd Sem. 2019-20
Course Code: MEC 101
Course Name: ELEMENTS OF MECHANICAL ENGINEERING
Program & Sem: B. TECH & 1ST SEM

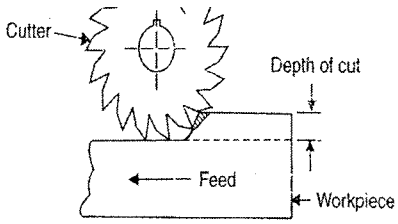
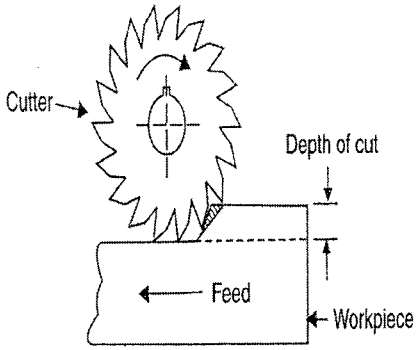
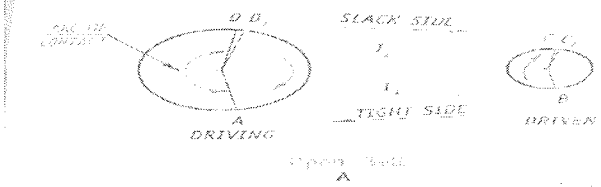
Date: 30.12.2019
Time: 1.00pm- 4.00pm HRS
Max Marks: 100
Weightage: 50%

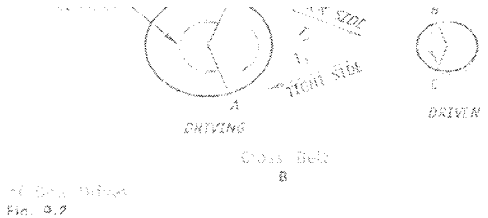
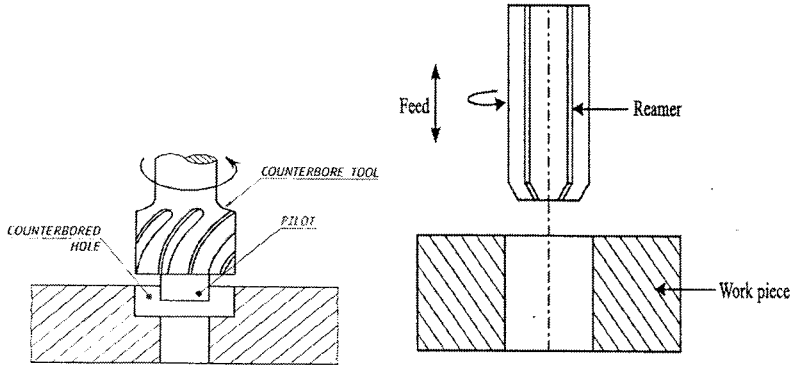
Part A (8Q x 5M = 40Mark

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	16 Pressure The pressure is defined as force per unit area. P = F / A □ Gauge pressure □ Absolute pressure □ Vacuum pressure Force per unit area exerted by a fluid (gas or liquid) on a solid surface. Absolute Pressure Pressure measured relative to an absolute vacuum (absolute zero pressure). Gauge Pressure Pressure greater than atmospheric pressure that are measured relative to atmospheric pressure. Gauge pressure is the difference between the absolute pressure and atmospheric pressure: Pgauge = Pabs – Patm Vacuum Pressure Pressure less than atmospheric pressure that are measured relative to atmospheric pressure. Vacuum pressure equals atmospheric pressure minus the absolute pressure: Pvac = Patm - Pabs Pressure unit in SI system is pascal (derived SI unit not base unit). 1 pascal equals to one newton per square meter. Other common pressure units are kilopascal (kpa), megapascal (mpa), psi (pound per square inch), torr (mmHg), atm (atmospheric pressure) and bar.	**Sketch 2 M** **Explanation 3 M**	**10**



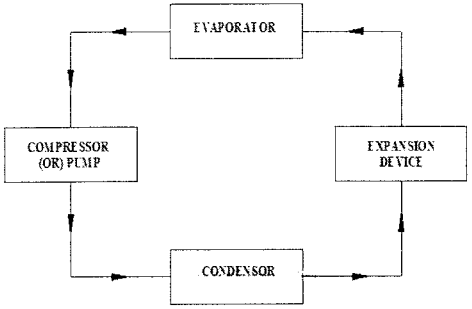
2	Zeroth Law of Thermodynamics:- Zeroth law of thermodynamics states that "the bodies A and B are in thermal equilibrium with a third body C separately then the two bodies A and B shall also be in thermal equilibrium with each other". This is the principle of temperature measurement.  The First law of the Thermodynamics is the application of the conservation of energy principle. The law of conservation of energy states that the total energy of an isolated system is constant; energy can be transformed from one form to another, but can be neither created nor destroyed. First Law of TD : $\Delta Q = \Delta E + \Delta W$ Second Law of Thermodynamics: **Kelvin–Planck Statement** It is impossible for any device that operates on a cycle to receive heat from a single reservoir and produce a net amount of work. **Clausius Statement** It is impossible to construct a device that operates in a cycle and produces no effect other than the transfer of heat from a lower-temperature body to a higher-temperature body.  	**Statement 3 M Equation and sketch 2 M**	**10**

		3M	
	 UP MILLING The work piece is fed opposite to the direction of the rotating cutter. Chips are progressively thicker. Since the cutting forces are directed upwards it tends to lift the work piece. Gives poor surface finish. Used for hard materials.  DOWN MILLING The work piece in the direction of the rotating cutter. Chips are progressively thinner. Cutting forces are directed downwards, which keep the work piece pressed to the table. Gives good surface finish. Used for soft materials and finishing operations		
4	 Both driver and driven pulley rotate in both direction. Belt is passed over driver and driven. Driver pulley pulls the belt from one side and delivers to other side. Tension is more in lower side then upper side.	**Sketch 2M Explanation 3M**	**10**

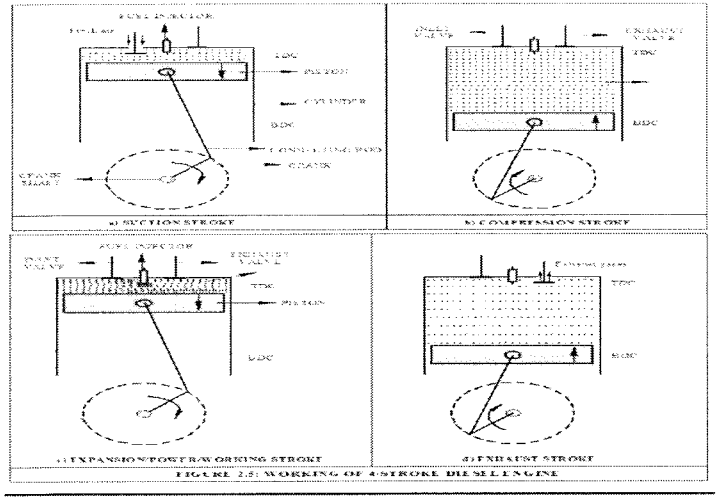
	 Fig. 3.9 Driven rotates in opposite direction to that of driver. At the point were the belt crosses it rubs against each other and there will be wear. To avoid this speed of belt should be less than 15 m/s.		
5	**Engineering Materials** A particular material is selected on the basis of following considerations: 1. **Properties of Material** • Mechanical Properties- Strength, Ductility, toughness, hardness etc. • Physical Properties- Density, Specific heat, melting point etc. • Chemical Properties – Corrosion, Oxidation, toxicity etc. 2. **Cost of material** 3. **Availability of material and reliability of material.** 4. **Service life of the material** (Dimensional stability of material wear, corrosion etc. shorten the life). 5. **Appearance of the material** (color, Surface texture etc)	**Each point 1 M**	5 min
6	 Counter boring is done to increase the size of the hole at one end by a small depth. The cutting tool will have a small cylindrical projection known as a pilot to guide the counterbore tool. The speed should be 2/3rd of the drilled hole. Reaming is a process of smoothing the surface of the drilled holes with a reamer. A reamer is similar to the twist drill, but has straight edges.	**Sketch 2M Explanation 3M**	**10**

Sl. No.	Two stroke Engine	Four stroke Engine
1	Requires two separate strokes to complete one cycle of operation.	Requires four separate strokes to complete one cycle of operation.
2	Power is developed in every revolution of the crankshaft	Power is developed for every revolutions of the crankshaft.
3	The inlet, transfer and exhaust ports are opened and closed by the movement of piston itself.	The inlet and exhaust are opened and closed by the valves.
4	Turing moment is not uniform and hence requires a heavier flywheel.	Turing moment is uniform and hence Requires lighter flywheel.
5	The charge is first admitted into the crankcase and then transferred to the engine cylinder.	The charge is directly admitted in to the engine cylinder during the suction stroke.
6	For the same power developed the engine is heavy and bulky.	For the same power developed the Engine is light and compact.

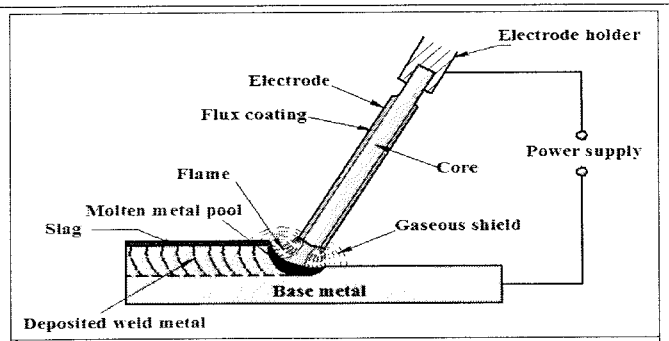
	7	low.	is high.		
	8	Requires greater lubricant and coolant.	Requires lesser lubricant and coolant.		
	9	Fuel consumption is more.	Fuel consumption is less.		
	10	Initial cost is less.	Initial cost is more.		

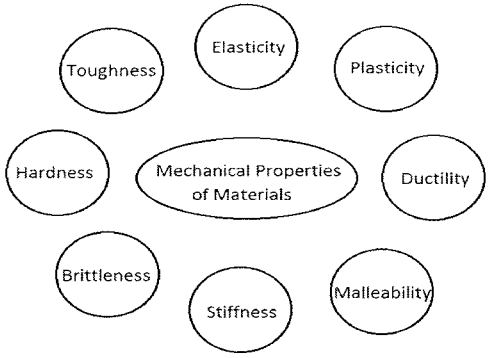
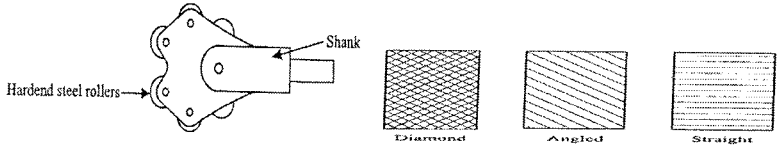
8	 FIGURE 5.1: PARTS OF A REFRIGERATOR a) Evaporator In the Evaporator, the liquid refrigerant is evaporated by absorbing the latent heat of Vaporization from the refrigerator cabinet in which the substances which have to be cooled are kept. It is considered as an heart of the refrigerator. Circulating system (Compressor or Pump) The purpose of the circulating system is to circulate the refrigerant to undergo the refrigeration cycle. The circulating system comprises of mechanical devices such as compressors or pumps. Generally these devices are driven ~~by electric~~ motors. The electrical input to the motor is the energy input to the refrigerators. c) Condenser In a condenser, the heat from the refrigerant is rejected at higher temperature to another medium, usually the atmospheric air. The refrigerant vapour rejects its latent heat to the air and consequently condenses into liquid so that it can be recirculated in the refrigeration cycle. d) Expansion device8 The function of an expansion device is to reduce the pressure and temperature of the liquid refrigerant before it passes to the evaporator.	**Definition 1M Sketch 2M Explanation 2M**	**10M**

Part B (3Q x 12M =36Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
9 a		**Sketch 2M Explanantion 4M**	10

Four-Stroke Diesel Engine:
The working principle of a Four-stroke diesel engine is based on theoretical diesel cycle.
Hence it is also called diesel cycle engine.
A Four-stroke diesel engine performs four different strokes to complete one cycle. The working of each stroke is shown in the Figure 2.5 and its details are discussed below.
(a)Suction stroke:
At the beginning of the stroke piston is in TDC and during the stroke, piston moves from TDC to BDC.
During this stroke the inlet valve opens and the exhaust valve will be closed.
The downward movement of the piston creates suction in the cylinder and as a result, fresh air is drawn into the cylinder through the inlet valve.
When the piston reaches the BDC, the suction stroke completes and this is represented by the line AB on P-V diagram as shown in the Figure 2.6.
(b)Compression stroke
At the beginning of the stroke piston is in BDC and during the stroke piston moves from BDC to TDC

	adiabatic in nature and is shown by the curve BC in P-V diagram. At the end of the stroke, the fuel (diesel) is sprayed into the cylinder by fuel injector. As the fuel comes in contact with the hot compressed air, it gets ignited and undergoes combustion at constant pressure. This process is shown by the line CD on PV diagram. At the point D fuel supply is cutoff. The compression ratio ranges from 16:1 to 20:1. (c)Power stroke / Expansion stroke/ Working stroke At the beginning of this stroke, piston is in TDC and during the stroke, piston moves from TDC to BDC. During this stroke both inlet and the exhaust valve remain closed. As combustion of fuel takes place, the burnt gases expand and exert a large force on the piston. Due to this, piston is pushed from TDC the BDC. (d) Exhaust stroke At the beginning of the stroke piston is in BDC and during this stroke, piston moves from BDC to TDC. During this stroke the inlet valve is closed and the exhaust valve is opened. As the piston moves upward, it forces the remaining burnt gases out of the cylinder through the exhaust valve. This is shown by the line BA on P- V diagram. When the piston reaches the TDC the exhaust valve closes. This completes the cycle.		
9 b	 Figure 4.4: Electric Arc welding process Principle: In this process the heat is produced by an electric arc. The arc produced by striking the electrode on the work piece and momentarily separated by a small gap of 2-4mm. this will assist in maintaining the arc between the work piece and electrode. Thus the electrical energy is converted into heat energy. The high temperature at the tip of the electrode is sufficient to melt the work piece. Also the electrode melts and combines with the molten metal of the work piece therby forming a homogeneous joint.	**Sketch 2M Explanantion 4M**	10

	electrode forms one pole of the circuit and the parts to be welded forms the other pole. The electrode acts as both filler metal as well as arc generator. The arc which is struck between the electrode and the work piece produces temperature ranging from 5000-6000oC. Thus the heat of the arc melts the work piece metal forming a small molten metal pool. At the same time, the electrode tip also melts and is transferred into the molten metal of the work piece in the form of globules(droplets) of molten metal. The molten metal fills the joint and bonds the joint to form a single piece of homogeneous metal.		
10 a.	 Elasticity :The ability to deform with respect to the applied load and regain its original shape when the load is removed. Plasticity :The ability of non-reversible deformation with respect to the applied load. Ductility: The ability to deform under tensile stress this is often characterized by the material's ability to be stretched into a wire. Malleability: The ability to be stretched/deformed/ moulded into a sheet. Stiffness: The ability of a material to resist deformations under the application of loads. Brittleness: The ability to breaks without significant deformation/develop cracks with respect to the applied load. Hardness: The ability to resist the scratches, marks, and wear & tear when the body subjected to contact with another body. Toughness: The ability to resist the shock loads or impact loads.		5 min
b.		**Sketch 3M** **Explanantion 3M**	10

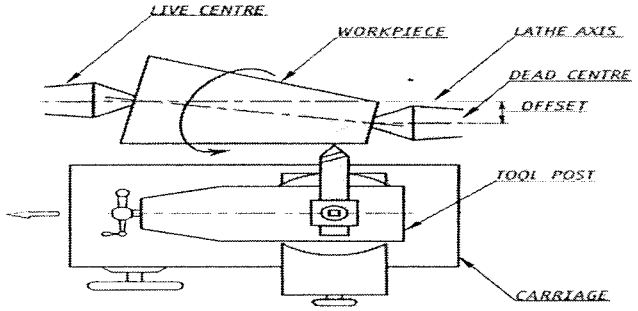
piece using a knurling tool.

It is used to produce straight, angled or diamond pattern on the work piece mainly for gripping purpose.

The knurling tool is set in the tool post such that upper and lower rollers of the knurl head touches the surface of the work piece.

The spindle speed is kept 60 to 80 rpm.

The feed of the knurl tool is 0.38 to 0.76 mm/rev.



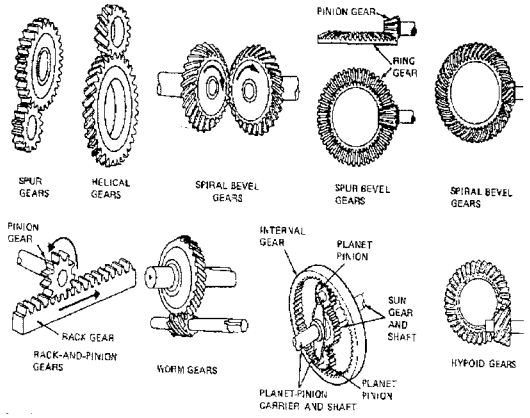
This is also known as "set over tailstock" method.

In this method, the tailstock of the lathe is offset to the axis of the lathe bed.

When the work piece is mounted between the centers, it will be inclined to the lathe bed.

The cutting tool is moved parallel to the lathe bed to cut the taper.

This method is suitable for long work pieces having less taper.

11 a.	 Spurs	Naming: 1M Listing types 1M Explaining any two 2M Each	10 min

	Rack and pinion		
b.	1) Pelton wheel 2) Francis Turbine 3) Kaplan turbine 4) Air Compressor 5) Piston Cylinder arrangement 6) Thermoflask	Each 1M	5 min

Part C (2Q x 12M = 24Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
12 a	Diameter of piston d= 250mm = 0.25m; Area, A= πd24 = π(0.25)24 = 0.049m2; Stroke, L = 400mm = 0.4m; Mean effective pressure, Pm = 4 bar; Speed, N = 500 rpm; Diameter of the brake drum, D = 1000mm = 1m; Radius of brake drum, R = 0.5m; Effective brake load, (W - S) = 400N; Assuming single cylinder engine, n = 1; For 4-stroke engine K=1/2 (a) Indicated power We know that, IP=nPmLANK□106□ kW IP=1∗4∗0.4∗0.049∗500∗12□106□ kW IP=32.6666 kw (b) Brake power BP=2πNT60∗1000 kW T=(W−S)R = 400*0.5 = 200 Nm BP=2π∗500∗20060∗1000 BP =10.444 kw (c) Friction power FP = IP – BP FP = 32.67 – 10.47 FP = 22.20kw	Each step Carries 2M Formulae and units 2M	10 min
12b	Soloution: Formulae P= (T1-T2)*v P = 400kw	Formulae 2M Calculation 2M	5 min
13 a	i) 500*10^5 Pascal ii) 392 farenheit iii) 449.817 K	Each carries 2M	10 min

	DiameterStroke=d_L=0.8; L=$d_{0.8}$=1.25d IP=nP_mLANK⍰106⍰ kW 15=4∗5∗1.25d∗πdd24∗1000∗12⍰106⍰ kW d = 0.09714m **d = 97.14mm** L = 1.25d L = 1.25*97.14 **L = 121.42mm**		