

**CENTRAL POLYTECHNIC COLLEGE, THARAMANI – 600113.**

**(An Autonomous Institution)**

**DEPARTMENT OF MECHANICAL  
ENGINEERING (TAMIL MEDIUM)**



**QUESTION BANK**

**EME51010 – ELEMENTS OF MACHINE DESIGN**

**(E – SCHEME)**

UNIT	Q NO	QUESTIONS
1	1	<p>What is the main objective of component design in engineering?</p> <p>(A) To manufacture all components in a similar way (B) To ensure the component fits, functions, and lasts under load (C) To reduce weight regardless of performance (D) To use expensive materials only</p> <p><b>Ans:B) To ensure the component fits, functions, and lasts under load</b></p>
1	2	<p>Which of the following is a property of engineering materials?</p> <p>(A) Color only (B) Melting without change (C) Mechanical strength (D) All of the above</p> <p><b>Ans:C) Mechanical strength</b></p>
1	3	<p>BIS stands for:</p> <p>(A) Bureau of Indian Standards (B) Bureau of International Standards (C) British International Standard (D) Bureau of Iron and Steel</p> <p><b>Ans:A) Bureau of Indian Standards</b></p>
1	4	<p>Which of the following is a non-ferrous material?</p> <p>(A) Cast iron (B) Mild steel (C) Copper (D) Wrought iron</p> <p><b>Ans:C) Copper</b></p>
1	5	<p>Non-ferrous materials do NOT contain:</p> <p>(A) Zinc (B) Aluminum (C) Iron (D) Copper</p> <p><b>Ans:C) Iron</b></p>
1	6	<p>Which of the following is a key factor in selecting materials for a machine component?</p> <p>(A) The designer's favorite color (B) The availability and cost of the material (C) The brand name of the material (D) The weight of the material only</p> <p><b>Ans:B) The availability and cost of the material</b></p>
1	7	<p>Which of the following factors affects the selection of materials in design?</p> <p>(A) Cost (B) Availability (C) Mechanical properties (D) All of the above</p> <p><b>Ans:D) All of the above</b></p>
1	8	<p>Preferred numbers in engineering design are used to:</p> <p>(A) Make random selections (B) Follow standard series of sizes (C) Choose maximum numbers (D) Ignore standardization</p> <p><b>Ans:B) Follow standard series of sizes</b></p>

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1	9	<p>The factor of safety (FoS) for ductile materials is the ratio of:</p> <p>(A) Working stress to ultimate stress      ( B) Yield stress to working stress  (C) Ultimate stress to yield stress      (D) Allowable stress to yield stress</p> <p><b>Ans:B) Yield stress to working stress</b></p>
1	10	<p>Factor of safety is used to:</p> <p>(A) Increase cost      ( B) Improve speed  (C) Prevent failure      (D) Improve appearance</p> <p><b>Ans:C) Prevent failure</b></p>
1	11	<p>Factor of safety is always:</p> <p>(A) Less than 1      ( B) Equal to 1  (C) Greater than 1      (D) Zero</p> <p><b>Ans:C) Greater than 1</b></p>
1	12	<p>What is allowable stress?</p> <p>(A) The maximum stress a material      ( B) The minimum stress required for failure  can withstand  (C) The maximum stress that is      (D) The same as ultimate stress  considered safe for a design</p> <p><b>Ans:C) The maximum stress that is considered safe for a design</b></p>
1	13	<p>If the yield stress is 400 MPa and factor of safety is 2, what is the allowable stress?</p> <p>(A) 100 MPa      ( B) 800 MPa  (C) 200 MPa      (D) 600 MPa</p> <p><b>Ans:C) 200 MPa</b></p>
1	14	<p>Tensile stress is caused by a load that tends to_____ the body.</p> <p>(A) Compress      ( B) Bend  (C) Elongate      (D) Twist</p> <p><b>Ans:C) Elongate</b></p>
1	15	<p>A force that pushes a material is known as:</p> <p>(A) Compression      ( B) Shear  (C) Tension      (D) Torsion</p> <p><b>Ans:A) Compression</b></p>
1	16	<p>Shear stress acts:</p> <p>(A) Along the length of the material      ( B) At a right angle to the surface  (C) Tangentially to the surface      (D) Does not act on solids</p> <p><b>Ans:C) Tangentially to the surface</b></p>



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1	25	<p>The application of composite materials is often found in:</p> <p>(A) Heavy construction ( B) Aerospace industry</p> <p>(C) Household utensils (D) Low-tech applications</p> <p><b>Ans:B) Aerospace industry</b></p>
1	26	<p>Creep occurs under:</p> <p>(A) Rapid loading ( B) High impact loading</p> <p>(C) Constant load for a long time at high temperature (D) Low temperature</p> <p><b>Ans:C) Constant load for a long time at high temperature</b></p>
1	27	<p>The three stages of a typical creep curve are:</p> <p>(A) Primary, Secondary, Tertiary ( B) Initial, Peak, Decline</p> <p>(C) Elastic, Plastic, Fracture (D) Loading, Unloading, Failure</p> <p><b>Ans:A) Primary, Secondary, Tertiary</b></p>
1	28	<p>The third stage of the creep curve is:</p> <p>(A) Recovery ( B) Constant strain rate</p> <p>(C) Primary deformation (D) Accelerated deformation</p> <p><b>Ans:D) Accelerated deformation</b></p>
1	29	<p>The S-N curve is used to determine the _____ of a material.</p> <p>(A) Ultimate strength ( B) Yield strength</p> <p>(C) Endurance limit (D) Hardness</p> <p><b>Ans:C) Endurance limit</b></p>
1	30	<p>In an S-N curve, 'N' stands for:</p> <p>(A) Nominal stress ( B) Number of cycles to failure</p> <p>(C) Newton (D) Neutral axis</p> <p><b>Ans:B) Number of cycles to failure</b></p>
1	31	<p>What is 'fatigue' in materials?</p> <p>(A) The failure of a material under static load ( B) The weakening of a material caused by repeatedly applied loads</p> <p>(C) The deformation of a material due to high temperature (D) The corrosion of a material</p> <p><b>Ans:B) The weakening of a material caused by repeatedly applied loads</b></p>
1	32	<p>Fatigue failure is caused by:</p> <p>(A) Static loads ( B) Impact loads</p> <p>(C) Repeated or fluctuating loads (D) High temperature</p> <p><b>Ans:C) Repeated or fluctuating loads</b></p>

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1	33	<p>Endurance limit is the:</p> <p>(A) Maximum load before rupture      ( B) Minimum load to cause yielding</p> <p>(C) Stress below which fatigue failure will not occur      (D) Load to cause permanent deformation</p> <p><b>Ans:C) Stress below which fatigue failure will not occur</b></p>
1	34	<p>Stress concentration occurs due to:</p> <p>(A) Uniform geometry      ( B) Smooth surfaces</p> <p>(C) Notches, holes, or sharp changes in cross-section      (D) Uniform material</p> <p><b>Ans:C) Notches, holes, or sharp changes in cross-section</b></p>
1	35	<p>Which of the following causes stress concentration?</p> <p>(A) Uniform cross-section      ( B) Sudden changes in cross-section</p> <p>(C) Smooth surface      (D) Constant temperature</p> <p><b>Ans:B) Sudden changes in cross-section</b></p>
1	36	<p>Which method is not used to reduce stress concentration?</p> <p>(A) Adding notches      ( B) Fillet radius</p> <p>(C) Material grading      (D) Providing relief grooves</p> <p><b>Ans:A) Adding notches</b></p>
1	37	<p>The principal stress theory assumes failure when:</p> <p>(A) Shear strain exceeds critical value      ( B) Maximum normal stress exceeds ultimate stress</p> <p>(C) Distortion energy reaches a limit      (D) All stresses become equal</p> <p><b>Ans:B) Maximum normal stress exceeds ultimate stress</b></p>
1	38	<p>Theories of failure are used to predict:</p> <p>(A) The color change of a material      ( B) The yielding or fracture of a material under combined stresses</p> <p>(C) The cost of a component      (D) The manufacturing process</p> <p><b>Ans:B) The yielding or fracture of a material under combined stresses</b></p>
1	39	<p>Principal normal stress theory is also called:</p> <p>(A) Guest theory      ( B) Rankine theory</p> <p>(C) Tresca theory      (D) Von Mises theory</p> <p><b>Ans:B) Rankine theory</b></p>
1	40	<p>Stress concentration factor (<math>K_t</math>) is the ratio of:</p> <p>(A) Mean stress to alternating stress      ( B) Nominal stress to maximum stress</p> <p>(C) Maximum stress to nominal stress      (D) Strain to stress</p> <p><b>Ans:C) Maximum stress to nominal stress</b></p>

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1	41	<p>What is the unit of stress?</p> <p>(A) N ( B) N-m</p> <p>(C) N/m<sup>2</sup> (Pascals) (D) m/s<sup>2</sup></p> <p><b>Ans:C) N/m<sup>2</sup> (Pascals)</b></p>
1	42	<p>Mild steel is also known as:</p> <p>(A) Tool steel ( B) Low carbon steel</p> <p>(C) Alloy steel (D) White iron</p> <p><b>Ans:B) Low carbon steel</b></p>
1	43	<p>Which steel is best suited for gears and heavy-duty shafts?</p> <p>(A) Cast iron ( B) Stainless steel</p> <p>(C) High-carbon steel (D) Alloy steel (e.g. 40Cr1Mo28)</p> <p><b>Ans:D) Alloy steel</b></p>
1	44	<p>1 MPa is equal to how many N/mm<sup>2</sup>?</p> <p>(A) 0.1 N/mm<sup>2</sup> ( B) 1 N/mm<sup>2</sup></p> <p>(C) 10 N/mm<sup>2</sup> (D) 100 N/mm<sup>2</sup></p> <p><b>Ans:B) 1 N/mm<sup>2</sup></b></p>
1	45	<p>Stainless steel contains:</p> <p>(A) Carbon and lead ( B) Copper and iron</p> <p>(C) Iron and chromium (D) Zinc and copper</p> <p><b>Ans:C) Iron and chromium</b></p>
1	46	<p>Ductility is the property by which a material can undergo large _____ deformation.</p> <p>(A) Elastic ( B) Plastic</p> <p>(C) Brittle (D) Thermal</p> <p><b>Ans:B) Plastic</b></p>
1	47	<p>In the BIS system, 50C4 means:</p> <p>(A) 0.50% Carbon, 0.4% Chromium ( B) 0.5% Carbon, 0.4% Manganese</p> <p>(C) 0.5% Carbon, 0.4% Carbon (D) Carbon and 4% Nickel</p> <p><b>Ans:B) 0.5% Carbon, 0.4% Manganese</b></p>
1	48	<p>Which component is most likely to suffer from stress concentration?</p> <p>(A) Smooth bar ( B) Threaded rod</p> <p>(C) Uniform beam (D) Homogeneous plate</p> <p><b>Ans:B) Threaded rod</b></p>

UNIT	Q NO	QUESTIONS
1	49	Which of the following does not typically cause stress concentration? (A) Keyways ( B) Fillets (C) Holes (D) Notches <b>Ans:B) Fillets</b>
1	50	Match the correct mechanical properties from the following: Match the correct mechanical properties from the following: 1. Ductility a) Resist abrasion and scratch 2. Malleability b) Drawn into thin wire 3. Hardness c) Resisting the elastic and plastic deformation 4. Toughness d) Hammered into thin sheet (A) 1-b, 2-d, 3-a, 4-c ( B) 1-a, 2-d, 3-b, 4-c (C) 1-b, 2-c, 3-a, 4-d (D) 1-d, 2-b, 3-a, 4-c <b>Ans:A) 1-b, 2-d, 3-a, 4-c</b>
2	51	What is the primary function of a coupling? (A) To connect two shafts and transmit power ( B) To increase the speed of a shaft (C) To support a rotating shaft (D) To act as a brake <b>Ans:A) To connect two shafts and transmit power</b>
2	52	Which of the following is not a requirement of a good coupling? (A) Easy to assemble ( B) Transmit torque (C) Frequent lubrication (D) Accommodate misalignment <b>Ans:C) Frequent lubrication</b>
2	53	A rigid coupling is used to connect shafts that are: (A) Perfectly aligned ( B) At an angle (C) Parallel but not aligned (D) Intersecting <b>Ans:A) Perfectly aligned</b>
2	54	Flange coupling bolts are subjected to: (A) Shear ( B) Bending (C) Torsion (D) Axial compression <b>Ans:A) Shear</b>
2	55	In a protected type flange coupling, the flange has a shroud to: (a) Increase the weight ( b) Cover the bolt heads and nuts for safety (c) Improve appearance (d) Reduce the transmitted torque <b>Ans:Answer: b) Cover the bolt heads and nuts for safety</b>
2	56	Which of the following is not a type of flexible coupling? (a) Jaw coupling ( b) Pin bush coupling (c) Flange coupling (d) Universal coupling <b>Ans:Answer: c) Flange coupling</b>

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2	57	<p>What is the function of a key in a machine?</p> <p>(a) To lock the machine ( b) To prevent relative rotational motion between a shaft and a hub</p> <p>(c) To support the shaft (d) To measure the shaft's speed</p> <p><b>Ans:Answer: b) To prevent relative rotational motion between a shaft and a hub</b></p>
2	58	<p>Why is a protected type flange coupling preferred over an unprotected one?</p> <p>(a) It is cheaper ( b) It provides safety for workers</p> <p>(c) It transmits more power (d) It is lighter</p> <p><b>Ans:Answer: b) It provides safety for workers</b></p>
2	59	<p>Marine couplings are specifically designed for:</p> <p>(a) High torque industrial drives ( b) Small gear assemblies</p> <p>(c) Ship propulsion systems (d) Electrical motors</p> <p><b>Ans:Answer: c) Ship propulsion systems</b></p>
2	60	<p>Pin-type couplings provide:</p> <p>(a) No flexibility ( b) High alignment tolerance</p> <p>(c) Misalignment flexibility via rubber bushes (d) Frictional locking</p> <p><b>Ans:Answer: c) Misalignment flexibility via rubber bushes</b></p>
2	61	<p>In flange coupling, flange is generally fixed on the shaft using:</p> <p>(a) Nut and bolt ( b) Key</p> <p>(c) Thread (d) Welding</p> <p><b>Ans:Answer: b) Key</b></p>
2	62	<p>In marine type flange couplings, the flanges are_____ on the end of the shafts.</p> <p>(a) Forged ( b) drawn</p> <p>(c) cut (d) weld</p> <p><b>Ans:a) Forged</b></p>
2	63	<p>Flexible couplings absorb:</p> <p>(a) Shaft tension ( b) Axial load</p> <p>(c) Shock and vibration (d) Friction loss</p> <p><b>Ans:Answer: c) Shock and vibration</b></p>
2	64	<p>In rigid flange coupling, the key takes:</p> <p>(a) No torque ( b) Half the torque</p> <p>(c) All the torque (d) None of the above</p> <p><b>Ans:Answer: c) All the torque</b></p>

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2	65	Which of the following is true for flange coupling? (a) Suitable for high misalignment      (b) Difficult to manufacture (c) Suitable for low-speed drives      (d) It has gear teeth <b>Ans:Answer: c) Suitable for low-speed drives</b>
2	66	If the shear stress in a key is 50 N/mm <sup>2</sup> and its shear area is 100 mm <sup>2</sup> , what is the shearing force? (a) 500 N      (b) 2 N (c) 5000 N      (d) 0.5 N <b>Ans:Answer: c) 5000 N</b>
2	67	A flange coupling has 4 bolts. If the total shear force on the bolts is 20,000 N, what is the shear force on each bolt? (a) 4000 N      (b) 5000 N (c) 20000 N      (d) 80000 N <b>Ans:Answer: b) 5000 N</b>
2	68	A rigid flange coupling connects two shafts of 50 mm diameter. What is a suitable diameter for the hub? (a) 50 mm      (b) 75 mm (c) 100 mm      (d) 125 mm <b>Ans:Answer: c) 100 mm</b>
2	69	Calculate the power transmitted by a shaft rotating at 1500 rpm (approx. 157 rad/s) and transmitting a torque of 200 N-m. (a) 31.4 kW      (b) 300 kW (c) 13.3 W      (d) 7.5 kW <b>Ans:Answer: a) 31.4 kW</b>
2	70	A flange coupling is designed to transmit 15 kW at 900 rpm. Calculate the torque. (a) 159.1 N-m      (b) 15000 N-m (c) 1.6 N-m      (d) 900 N-m <b>Ans:Answer: a) 159.1 N-m</b>
2	71	A flange coupling is designed to transmit 15 kW at 500 rpm. Calculate the Torque. (a) 159.1 N-m      (b) 15000 N-m (c) 286.5 N-m      (d) 900 N-m <b>Ans:Answer: c) 286.5 N-m</b>
2	72	A flange coupling is designed to transmit 15 kW at 500 rpm with safe stress of 60 N/mm <sup>2</sup> for shaft. Calculate the standard diameter of shaft. (a) 40 mm      (b) 30 mm (c) 25 mm      (d) 20 mm <b>Ans:Answer: 30 mm</b>



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2	81	<p>A gib-head key is a type of sunk key that:</p> <p>(a) Is tapered ( b) Has a head for easy removal</p> <p>(c) Is circular in cross-section (d) Does not use a keyway</p> <p><b>Ans:Answer: b) Has a head for easy removal</b></p>
2	82	<p>A key is generally made of:</p> <p>(a) Cast iron ( b) Copper</p> <p>(c) Mild steel (d) Aluminum</p> <p><b>Ans:Answer: c) Mild steel</b></p>
2	83	<p>A feather key is a type of sunk key that allows for:</p> <p>(a) Easy removal ( b) Axial movement of the hub on the shaft</p> <p>(c) Higher torque transmission (d) Misalignment</p> <p><b>Ans:Answer: b) Axial movement of the hub on the shaft</b></p>
2	84	<p>Which key does not require a keyway in the shaft?</p> <p>(a) Woodruff key ( b) Feather key</p> <p>(c) Saddle key (d) Rectangular sunk key</p> <p><b>Ans:Answer: c) Saddle key</b></p>
2	85	<p>The shear stress in a key is equal to the crushing stress. This happens when the key is</p> <p>(a) Rectangular key ( b) Square key</p> <p>(c) Tapered key (d) Feather key</p> <p><b>Ans:Answer: b) Square key</b></p>
2	86	<p>Effect of keyway on shaft strength results in:</p> <p>(a) Increase in torsional strength ( b) No change</p> <p>(c) Reduction in torsional strength (d) Only tensile reduction</p> <p><b>Ans:Answer: c) Reduction in torsional strength</b></p>
2	87	<p>A Woodruff key is shaped like:</p> <p>(a) A rectangle ( b) A square</p> <p>(c) A segment of a circular disc (d) A triangle</p> <p><b>Ans:Answer: c) A segment of a circular disc</b></p>
2	88	<p>The keyway cut into a shaft introduces:</p> <p>(a) Improved strength ( b) Stress concentration</p> <p>(c) Better alignment (d) Reduced weight</p> <p><b>Ans:Answer: b) Stress concentration</b></p>

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2	89	In design, key failure is considered due to: (a) Bending only ( b) Shear only (c) Shear and crushing (d) Torsion <b>Ans:Answer: c) Shear and crushing</b>
2	90	For high torque applications, the preferred key is: (a) Feather key ( b) Sunk key (c) Saddle key (d) Round key <b>Ans:Answer: b) Sunk key</b>
2	91	Taper in standard key is: (a) 1:100 ( b) 1:50 (c) 1:20 (d) 1:200 <b>Ans:Answer: a) 1:100</b>
2	92	In case of considering shear, key length (l) = (a) $T / (w \times h)$ ( b) $2 \times T / (\tau \times d \times w)$ (c) $T / (d \times t)$ (d) $T / (l \times t \times h)$ <b>Ans:b) <math>2 \times T / (\tau \times d \times w)</math></b>
2	93	A shaft of 60 mm diameter needs a rectangular sunk key. If the standard width is $d/4$ and thickness is $d/6$ , what are the dimensions? (a) $w=15$ mm, $t=10$ mm ( b) $w=10$ mm, $t=15$ mm (c) $w=20$ mm, $t=12$ mm (d) $w=12$ mm, $t=10$ mm <b>Ans:Answer: a) <math>w=15</math> mm, <math>t=10</math> mm</b>
2	94	A key of width 'w' transmits a torque 'T' on a shaft of diameter 'd'. The shearing force (F) on the key is calculated as: (a) $F = T / d$ ( b) $F = 2T / d$ (c) $F = T / w$ (d) $F = T * d$ <b>Ans:b) <math>F = 2T/d</math></b>
2	95	The shear strength of a key material is 300 MPa. If the factor of safety is 3, what is the allowable shear stress? (a) 900 MPa ( b) 303 MPa (c) 297 MPa (d) 100 MPa <b>Ans:d) 100 MPa</b>
2	96	The crushing strength of a key is 400 MPa and the crushing stress induced is 100 MPa. What is the factor of safety? (a) 4 ( b) 0.25 (c) 300 (d) 500 <b>Ans:a) 4</b>



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3	105	<p>Condition for maximum power transmission in flat belt occurs when:</p> <p>(A) Tension is maximum                      ( B) Centrifugal tension = 1/3 of maximum tension</p> <p>(C) Velocity is zero                              (D) Slip is zero</p> <p><b>Ans:B) Centrifugal tension = 1/3 of maximum tension</b></p>
3	106	<p>The length of open flat belt drive is given by:</p> <p>(A) <math>L = 2C + \pi(d_2+d_1)/2 + (d_2-d_1)^2/4C</math>    ( B) <math>L = 4\pi(d_2-d_1) + 2C</math></p> <p>(C) <math>L = 2\pi(d_2-d_1) + 4C</math>                      (D) <math>L = 4C + \pi(d_2+d_1)/2 + (d_2-d_1)^2/2C</math></p> <p><b>Ans:A) <math>L = 2C + \pi(d_2+d_1)/2 + (d_2-d_1)^2/4C</math></b></p>
3	107	<p>Which of the following is NOT a standard belt material?</p> <p>(A) Leather    ( B) Cotton</p> <p>(C) Rubber    (D) Asbestos</p> <p><b>Ans:D) Asbestos</b></p>
3	108	<p>Which pulley has larger diameter in a speed reducing flat belt drive?</p> <p>(A) Driver    ( B) Driven</p> <p>(C) Idler    (D) Both equal</p> <p><b>Ans:B) Driven</b></p>
3	109	<p>The length of the belt depends on the center distance and the _____.</p> <p>(A) Belt material                                      ( B) Pulley diameters</p> <p>(C) Belt speed                                        (D) Power transmitted</p> <p><b>Ans:B) Pulley diameters</b></p>
3	110	<p>Creep in a belt is caused by:</p> <p>(A) The elongation and contraction of the belt as it passes from tight to slack side    ( B) The belt slipping on the pulley surface</p> <p>(C) The high operating temperature              (D) The belt material being too old</p> <p><b>Ans:A) The elongation and contraction of the belt as it passes from tight to slack side</b></p>
3	111	<p>_____ are not made endless. There is a joint.</p> <p>(A) White belt    ( B) Flat belt</p> <p>(C) V-belt    (D) Black belt</p> <p><b>Ans:B) Flat belt</b></p>
3	112	<p>In belt drives, the slack side has:</p> <p>(A) Higher tension                                      ( B) Lower tension</p> <p>(C) Same tension                                        (D) No tension</p> <p><b>Ans:B) Lower tension</b></p>



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3	121	Which factor does not affect centrifugal tension? (A) Mass of belt ( B) Belt speed (C) Belt width (D) Belt length <b>Ans:D) Belt length</b>
3	122	The tension in the tight side of the belt is: (A) Equal to slack side ( B) Less than slack side (C) Greater than slack side (D) Zero <b>Ans:C) Greater than slack side</b>
3	123	Arc of contact for cross flat belt drive is: (A) $\theta = 180^\circ - [(d_2-d_1)/c \times 60^\circ]$ ( B) $\theta = 180^\circ + [(d_2-d_1)/c \times 60^\circ]$ (C) $\theta = 180^\circ - [(d_2+d_1)/c \times 60^\circ]$ (D) $\theta = 180^\circ + [(d_2+d_1)/c \times 60^\circ]$ <b>Ans:D) <math>\theta = 180^\circ + [(d_2+d_1)/c \times 60^\circ]</math></b>
3	124	The included angle ( $2\alpha$ ) of the V groove on the pulley is usually (A) $30^\circ$ to $40^\circ$ ( B) $10^\circ$ to $20^\circ$ (C) $50^\circ$ to $80^\circ$ (D) $60^\circ$ to $70^\circ$ <b>Ans:A) <math>30^\circ</math> to <math>40^\circ</math></b>
3	125	One advantage of V-belts is: (A) Can operate in wet conditions ( B) Requires less maintenance (C) High speed capability (D) Self-aligning ability <b>Ans:B) Requires less maintenance</b>
3	126	Which one is not desired properties of a belt material? (A) high coefficient of friction ( B) flexibility (C) strength, ductility (D) hardness <b>Ans:D) hardness</b>
3	127	Power transmitted in belts is proportional to: (A) Belt area( $w \times t$ ) ( B) Belt length( $l$ ) (C) $(T_1-T_2) \times v$ (D) $(T_1+T_2)$ <b>Ans:C) <math>(T_1-T_2) \times v</math></b>
3	128	Calculate the speed ratio for a drive with a driver pulley diameter of 150 mm and a driven pulley diameter of 450 mm. (A) 1:3 ( B) 3:1 (C) 1:2 (D) 2:1 <b>Ans:B)3:1</b>





UNIT	Q NO	QUESTIONS
3	145	<p>The diameter of bigger and smaller pulleys are 840 mm and 280 mm. The centre distance between the pulley is 1.68 m. Find the arc of contact of the belt in degree. [Assume cross belt drive]</p> <p>(A) 222° ( B) 220° (C) 160° (D) 216°</p> <p><b>Ans:B) 220°</b></p>
3	146	<p>The diameter of bigger and smaller pulleys are 840 mm and 280 mm. The centre distance between the pulley is 1.68 m. Find the arc of contact of the belt in degree. [Assume open belt drive]</p> <p>(A) 222° ( B) 220° (C) 160° (D) 166°</p> <p><b>Ans:C) 160°</b></p>
3	147	<p>A leather belt which is 125 mm wide and 6 mm thick and stress in tight side is 2.75 N/mm<sup>2</sup>. Determine the maximum tension on the tight side of the belt?</p> <p>(A) 2062.5 N ( B) 1962.5 N (C) 1862.5 N (D) 2162.5 N</p> <p><b>Ans:A) 2062.5 N</b></p>
3	148	<p>The following data of V belt drive: Diameter of driving pulley = 150 mm, Speed of driving pulley = 1000 rpm. Find the velocity of belt (V).</p> <p>(A) 6.85 m/s ( B) 8.85 m/s (C) 7.85 m/s (D) 5.67 m/s</p> <p><b>Ans:C) 7.85 m/s</b></p>
3	149	<p>The following data of V belt drive: Diameter of driven pulley = 500 mm, Diameter of driving pulley = 150 mm, Centre distance between the pulley = 925 mm. Find the Arc of contact of (<math>\theta</math>) belt.</p> <p>(A) 147.3° ( B) 157.3° (C) 137.3° (D) 127.3°</p> <p><b>Ans:B) 157.3°</b></p>
3	150	<p>The following data of V belt drive: Rated Power <math>P = 7.5</math> kW, Service Factor <math>K_s = 1.3</math>, Correction Factor for Length <math>K_l = 1.05</math> and Arc of contact Factor <math>K_\theta = 0.95</math>. Find the design power <math>P_d</math> of V belt.</p> <p>(A) 7.8 kW ( B) 6.8 kW (C) 8.9 kW (D) 9.8 kW</p> <p><b>Ans:D) 9.8 kW</b></p>
4	151	<p>What is the primary function of a bearing?</p> <p>(A) To connect shafts, hub and inserted key ( B) To support a moving part and guide its motion (C) To transmit power and torque with speed (D) To stop motion at shock load condition</p> <p><b>Ans:B) To support a moving part and guide its motion</b></p>
4	152	<p>Bearings are broadly classified into _____ contact bearing and _____ contact bearings.</p> <p>(A) Sliding, Rolling ( B) Fixed, Variable (C) Flexible, Rigid (D) Steady, Unsteady</p> <p><b>Ans:A) Sliding, Rolling</b></p>

UNIT	Q NO	QUESTIONS
4	153	Sliding and Rolling contact bearing are also called as _____ bearing and _____ bearing. (A) Flexible, Rigid ( B) Journal and Antifriction (C) Viscous, In-viscous (D) Compressible, Incompressible <b>Ans:B) Journal and Antifriction</b>
4	154	Which type of bearing supports loads perpendicular to the shaft axis? (A) Thrust bearing ( B) Radial bearing (C) Journal bearing (D) Roller bearing <b>Ans:B) Radial bearing</b>
4	155	In thrust bearings, the load or force acts _____ of rotation of the moving parts. (A) nonlinear to the axis ( B) curvilinear to the axis (C) along the axis (D) neutral axis <b>Ans:C) along the axis</b>
4	156	Which of the following is NOT a type of sliding bearing? (A) Full journal ( B) Partial journal (C) Hydrostatic (D) Roller <b>Ans:D) Roller</b>
4	157	Which of the following is NOT a type of roller bearing? (A) Cylindrical roller bearing ( B) Tapered roller bearing (C) Spherical roller bearing (D) Plain journal bearing <b>Ans:D) Plain journal bearing</b>
4	158	In Partial journal bearing, the angle of contact of the bearing with the journal is _____ being a common value. (A) 190° ( B) 120° (C) 280° (D) 250° <b>Ans:B) 120°</b>
4	159	In Full journal bearing, the angle of contact of the bearing with the journal is _____. (A) 190° ( B) 180° (C) 280° (D) 360° <b>Ans:D) 360°</b>
4	160	There is clearance between journal and the bearing. Full and partial journal bearing are known as _____. (A) clearance bearing ( B) fitted bearing (C) allowance bearing (D) slipper bearing <b>Ans:A) clearance bearing</b>

UNIT	Q NO	QUESTIONS
4	161	The following is not an element of rolling contact bearing. (A) Outer race ( B) Inner race (C) Cage (D) Collar <b>Ans:D) Collar</b>
4	162	Rolling contact bearings are preferred over sliding contact bearings because they: (A) Have higher friction ( B) Require more lubrication (C) Have lower friction and longer life (D) Are cheaper <b>Ans:C) Have lower friction and longer life</b>
4	163	What is the function of a cage or separator in a ball bearing? (A) To carry the load ( B) To keep the balls evenly spaced (C) To lubricate the bearing (D) To seal the bearing <b>Ans:B) To keep the balls evenly spaced</b>
4	164	Which material is suitable for general application of journal bearings? (A) stainless steel ( B) Babbit metal (C) Cast iron (D) Aluminum <b>Ans:B) Babbit metal</b>
4	165	The material used for ball and roller bearings is: (A) low carbon chromium steel ( B) high carbon chromium steel (C) fabric steel (D) bronze steel <b>Ans:B) high carbon chromium steel</b>
4	166	Anti friction bearing also known as _____ bearing. It has _____ of friction. (A) rolling Contact, lower coefficient ( B) sliding contact, higher coefficient (C) thrust bearing, medium coefficient (D) saddle bearing, zero coefficient <b>Ans:A) rolling Contact, lower coefficient</b>
4	167	Which radial type ball bearing permits the misalignment of shaft within 2 to 3 degrees? (A) single row deep groove bearing ( B) double row deep groove bearing (C) angular contact bearing (D) self-aligning bearing <b>Ans:D) self-aligning bearing</b>
4	168	Taper roller type thrust ball bearing have the rollers and race ways in _____ shape. (A) elliptical ( B) rectangular (C) truncated cone (D) parabolic <b>Ans:C) truncated cone</b>

UNIT	Q NO	QUESTIONS
4	169	<p>Which type of thrust ball bearing can carry both radial load and thrust load?            (A) self-aligning bearing                      ( B) spherical roller bearing            (C) Needle roller bearing                      (D) Tapered roller bearing</p> <p><b>Ans:D) Tapered roller bearing</b></p>
4	170	<p>Which bearing type is used in automotive wheels?            (A) Thrust bearing                                  ( B) Tapered roller bearing            (C) Ball bearing                                    (D) Journal bearing</p> <p><b>Ans:B) Tapered roller bearing</b></p>
4	171	<p>Which factor is NOT considered in Indian standard bearing designation?            (A) Bore diameter                                  ( B) Types            (C) Manufacturer logo                              (D) Type of service</p> <p><b>Ans:C) Manufacturer logo</b></p>
4	172	<p>Which material is suitable for high load application of sliding contact and ball bearings?            (A) stainless steel                                  ( B) Babbitt metal            (C) Cast iron                                        (D) Brass or Bronze</p> <p><b>Ans:D) Brass or Bronze</b></p>
4	173	<p>Which material of non-metallic bearing is suitable for food processing equipment?            (A) Carbon-graphite                                ( B) Sodium-chloride            (C) Silver-graphite                                (D) Carbon chloride</p> <p><b>Ans:A) Carbon-graphite</b></p>
4	174	<p>The designation of "NU" series in roller bearings adopted by SKF ball bearing company indicates:            (A) Single row deep groove                      ( B) Double row deep groove            (C) Cylindrical roller bearing                      (D) Thrust bearing</p> <p><b>Ans:C) Cylindrical roller bearing</b></p>
4	175	<p>Diametral clearance (C) is the difference between the diameter of _____ and the diameter of _____.            (A) bearing and journal                              ( B) cotter and sleeve            (C) hub and sleeve                                    (D) flange and hub</p> <p><b>Ans:A) bearing and journal</b></p>
4	176	<p>Diametral clearance Ratio (C/D) is the ratio of diametral _____ to the diameter of _____.            (A) flange and clearance                              ( B) clearance and sleeve            (C) hub and clearance                                (D) clearance and journal</p> <p><b>Ans:D) clearance and journal</b></p>

UNIT	Q NO	QUESTIONS
4	177	<p>Rubbing velocity (V) of journal is _____ m/s.</p> <p>(A) <math>(\pi \times D \times N)/(60 \times 1000)</math> (B) <math>(\pi \times D \times N)/(60 \times 10)</math>  (C) <math>(2 \times \pi \times N \times T)/60</math> (D) <math>(60 \times P)/2 \times \pi \times N</math></p> <p><b>Ans:</b>  <b>A) <math>(\pi \times D \times N)/(60 \times 1000)</math></b></p>
4	178	<p>The factor <math>ZN/p</math> is known as _____.</p> <p>(A) Bearing Mckee's number (B) Bearing Characteristic number  (C) Bearing Petroff's number (D) Bearing Lashe's number</p> <p><b>Ans:B) Bearing Characteristic number</b></p>
4	179	<p>Based on experiments, Mckee's obtained the following approximate equation for the coefficient of friction in a well lubricated full journal bearing:</p> <p>(A) <math>\mu = [0.456 \times ZN/p \times c/D] + h</math> (B) <math>\mu = [0.826 \times ZN/p \times c/D] + r</math>  (C) <math>\mu = [0.326 \times ZN/p \times D/c] + k</math> (D) <math>\mu = [0.589 \times ZN/p \times D/c] + w</math></p> <p><b>Ans:C) <math>\mu = [0.326 \times ZN/p \times D/c] + k</math></b></p>
4	180	<p>Mass of oil required for artificial cooling is found by using the equation _____.</p> <p>(A) <math>m_a = (Q_i - Q_e) / C_t \Delta t_i</math> (B) <math>m_a = (Q_d - Q_g) / c_d \Delta p_o</math>  (C) <math>m_a = (Q_e - Q_i) / C_v \Delta a_o</math> (D) <math>m_a = (Q_g - Q_d) / c_p \Delta t_o</math></p> <p><b>Ans:D) <math>m_a = (Q_g - Q_d) / c_p \Delta t_o</math></b></p>
4	181	<p>The unit of absolute viscosity (Z) 1 centi-poise is equal to how many m<sup>2</sup>Ns? i.e.,  1cp = ___Ns-m<sup>2</sup> or Pa-s</p> <p>(A) 1000 (B) 100  (C) 1/1000 (D) 1/ 100</p> <p><b>Ans:C) 1/1000</b></p>
4	182	<p>What is the absolute viscosity of SAE 20 type lubricating oil for journal bearing at the temperature 65°C?</p> <p>(A) 0.017 Pa-s (B) 0.170 Pa-s  (C) 0.107 Pa-s (D) 0.701 Pa-s</p> <p><b>Ans:A) 0.017 Pa-s</b></p>
4	183	<p>A 3 kN load(P) is supported by a journal bearing of 35 mm diameter(D) and 75 mm long(L). Find out the bearing pressure(p).</p> <p>(A) 1.3333 N/mm<sup>2</sup> (B) 1.1429 N/mm<sup>2</sup>  (C) 2.6333 N/mm<sup>2</sup> (D) 3.7333 N/mm<sup>2</sup></p> <p><b>Ans:B) 1.1429 N/mm<sup>2</sup></b></p>
4	184	<p>A 50 mm diameter(D) and 75 mm long(L) journal bearing is loaded with bearing pressure(p) of 2 MPa. Find out the Load(P) on the bearing.</p> <p>(A) 6000 N (B) 7000 N  (C) 7500 N (D) 8000 N</p> <p><b>Ans:C) 7500 N</b></p>

*EMC51010-ELEMENTS OF MACHINE DESIGN*  
**QUESTIONS**

- | UNIT | Q NO |  |
|------|------|--|
| 4    | 185  | A Journal bearing of 60 mm diameter(D) and speed(N) of rotation 1450 rpm. Calculate the rubbing velocity(V) of bearing.<br>(A) 3.5553 m/s ( B) 2.5553 m/s<br>(C) 1.5553 m/s (D) 4.5553 m/s<br><b>Ans:D) 4.5553 m/s</b>   |
| 4    | 186  | A journal bearing carries a radial load(P) of 9 kN and rubbing velocity(V) at 9.456 m/s, and assume Coefficient of friction ( $\mu$ ) = 0.0705. Calculate the amount of Heat generated [Qg] for journal bearing.<br>(A) 5999.832 J/s ( B) 7999.832 J/s<br>(C) 8999.832 J/s (D) 6999.832 J/s<br><b>Ans:A) 5999.832 J/s</b>  |
| 4    | 187  | A 75 mm diameter (D) journal bearing 100 mm long (L) and temperature difference between bearing surface and ambient temperature of $\Delta t=31^{\circ}\text{C}$ . Calculate the amount of heat dissipated [Qd] and assume light and medium construction.<br>(A) 87.75 J/s ( B) 37.21 J/s<br>(C) 57.65 J/s (D) 67.55 J/s<br><b>Ans:B) 37.21 J/s</b>  |
| 4    | 188  | A journal bearing carries a radial load(P) of 9 kN, rubbing velocity (V) at 9.425 m/s. The power lost in friction is 6 kW. Find out the coefficient of friction.<br>(A) $\mu=0.17773$ ( B) $\mu=0.27773$<br>(C) $\mu=0.07073$ (D) $\mu=0.37073$<br><b>Ans:C) <math>\mu=0.07073</math></b>  |
| 4    | 189  | The heat generated [Qg] and heat dissipated [Qd] of journal bearing are 695.139 J/s and 61.524 J/s. The temperature difference between outlet and inlet temperature of oil $\Delta t_o=8^{\circ}\text{C}$ . Calculate the mass of required for artificial cooling. Specific heat of<br>(A) 8.65 kg/min ( B) 3.77 kg/min<br>(C) 6.65 kg/min (D) 2.77 kg/min<br><b>Ans:D) 2.77 kg/min</b>  |
| 4    | 190  | If heat dissipated [Qd] < heat generated [Qg], What is required to carry away the heat from the bearing?<br>(A) Natural cooling ( B) Artificial cooling<br>(C) No cooling (D) Moderate Cooling<br><b>Ans:B) Artificial cooling</b>   |
| 4    | 191  | Find the Sommerfeld number (S) and friction variable from dimensionless performance parameter for full journal bearing, if ratio between the length and diameter (L/D) is 1 and minimum film thickness variable ( $2h_o/c$ ) is 0.4.<br>(A) $S=0.121, \mu(D/c)=3.22$ ( B) $S=0.221, \mu(D/c)=4.22$<br>(C) $S=0.321, \mu(D/c)=5.22$ (D) $S=0.421, \mu(D/c)=6.22$<br><b>Ans:A) <math>S=0.121, \mu(D/c)=3.22</math></b>   |
| 4    | 192  | Find the value of L/D ratio, allowable bearing pressure(p) N/m <sup>2</sup> and minimum operating bearing characteristic number $ZN/p \times 10^{-6}$ for a centrifugal pump from design parameters for journal bearing.<br>(A) L/D=2.6, p=2.4, $(ZN/p)_{\min} \times 10^{-6}=38.44$ ( B) L/D=1.6, p=1.4, $(ZN/p)_{\min} \times 10^{-6}=28.44$<br>(C) L/D=0.6, p=0.4, $(ZN/p)_{\min} \times 10^{-6}=00.44$ (D) L/D=3.6, p=3.4, $(ZN/p)_{\min} \times 10^{-6}=38.44$<br><b>Ans:B) L/D=1.6, p=1.4, <math>(ZN/p)_{\min} \times 10^{-6}=28.44</math></b> |

*EMC51010-ELEMENTS OF MACHINE DESIGN*  
**QUESTIONS**

- | UNIT | Q NO |  |   |
|------|------|--|---|
| 4    | 193  | Heat generated of the bearing [Qg] J/s = _____.<br>(A) $\mu \times D \times C$<br>(C) $\mu \times P \times V$<br><b>Ans:C) <math>\mu \times P \times V</math></b>  | ( B) $\mu \times L \times D$<br>(D) $\mu \times Z \times V$   |
| 4    | 194  | Heat dissipated of the bearing [Qd] J/s = _____.<br>(A) $P \cdot D \cdot (\Delta t + 28)^2 / C \times 106$<br>(C) $R \cdot D \cdot (\Delta t + 48)^2 / H \times 106$<br><b>Ans:D) <math>L \cdot D \cdot (\Delta t + 18)^2 / K \times 106</math></b>  | ( B) $V \cdot D \cdot (\Delta t + 38)^2 / S \times 106$<br>(D) $L \cdot D \cdot (\Delta t + 18)^2 / K \times 106$ |
| 4    | 195  | A 100 mm diameter(D) and 100 mm long(L) journal bearing is loaded with bearing pressure(p) of 0.5 MPa. Find out the Load (P) on the bearing.<br>(A) 6000 N<br>(C) 7500 N<br><b>Ans:B) 5000 N</b>   | ( B) 5000 N<br>(D) 8000 N   |
| 4    | 196  | A Journal bearing of 50 mm diameter(D) and speed(N) of rotation 500 rpm. Calculate the rubbing velocity(V) of bearing.<br>(A) 2.309 m/s<br>(C) 1.309 m/s<br><b>Ans:C) 1.309 m/s</b>  | ( B) 3.309 m/s<br>(D) 4.309 m/s   |
| 4    | 197  | A 9 kN load(P) is supported by a journal bearing of 500 mm diameter(D) and 150 mm long(L). Find out the bearing pressure(p).<br>(A) 0.14 N/mm <sup>2</sup><br>(C) 0.15 N/mm <sup>2</sup><br><b>Ans:D) 0.12 N/mm<sup>2</sup></b>  | ( B) 0.13 N/mm <sup>2</sup><br>(D) 0.12 N/mm <sup>2</sup>   |
| 4    | 198  | A journal bearing carries a radial load(P) of 20kN and rubbing velocity(V) at 4.7124 m/s, and assume Coefficient of friction ( $\mu$ ) = 0.0051. Calculate the amount of Heat generated [Qg] for journal bearing.<br>(A) 480.665 J/s<br>(C) 557.656 J/s<br><b>Ans:A) 480.665 J/s</b>   | ( B) 370.215 J/s<br>(D) 687.545 J/s   |
| 4    | 199  | A 100 mm diameter (D) journal bearing 160 mm long (L) and temperature difference between bearing surface and ambient temperature of $t_b - t_a = 19.75^\circ\text{C}$ . Calculate the amount of heat dissipated [Qd] and heat dissipation coefficient $C_d = 1232 \text{ J/s/m}^2/^\circ\text{C}$ .<br>(A) 689.312 J/s<br>(C) 889.312 J/s<br><b>Ans:B) 389.312 J/s</b> | ( B) 389.312 J/s<br>(D) 789.312 J/s   |
| 4    | 200  | Bearing characteristic number of journal bearing for centrifugal pump $ZN/p = 30 \times 10^{-6}$ , bearing pressure(p) of $1.0352 \times 10^6 \text{ N/m}^2$ and speed (N) of 1440 rpm. Find out the absolute viscosity of oil.<br>(A) 0.1216 Ns/m <sup>2</sup><br>(C) 0.0216 Ns/m <sup>2</sup><br><b>Ans:C) 0.0216 Ns/m<sup>2</sup></b>                               | ( B) 0.2216 Ns/m <sup>2</sup><br>(D) 0.4516 Ns/m <sup>2</sup>   |

UNIT	Q NO	QUESTIONS
5	201	<p>CAD stands for ____.</p> <p>(A) Computer Advanced Decorating      ( B) Computer Analysis Decoding  (C) Computer Aided Design                (D) Common Application Development</p> <p><b>Ans:C) Computer Aided Design</b></p>
5	202	<p>What is the primary role of CAD in design?</p> <p>(A) Manufacturing only                      ( B) Designing and development  (C) Testing software                         (D) Data storage</p> <p><b>Ans:B) Designing and development</b></p>
5	203	<p>Which of the following is an advantage of CAD?</p> <p>(A) Increased manual effort                ( B) Improved accuracy  (C) Limited design options                 (D) Slower production</p> <p><b>Ans:B) Improved accuracy</b></p>
5	204	<p>AutoCAD software is developed and marketed by ____.</p> <p>(A) Autodesk, Inc.                            ( B) Microsoft  (C) Intel    (D) HCL</p> <p><b>Ans:A) Autodesk, Inc.</b></p>
5	205	<p>Which one is not performed as engineering analysis in CAD?</p> <p>(A) Mass property calculation              ( B) Simulation  (C) Finite Element Analysis                (D) Process Techniques</p> <p><b>Ans:D) Process Techniques</b></p>
5	206	<p>CAD system can not be used to do ____.</p> <p>(A) Two-Dimensional Drafting              ( B) Three-Dimensional Modelling  (C) Interactive Computer Graphics        (D) Beauty and Cooking Modernization</p> <p><b>Ans:D) Beauty and Cooking Modernization</b></p>
5	207	<p>The one of following is not a major CAD/CAM system:</p> <p>(A) CATIA                                        ( B) IDEAS  (C) Solid Works                                 (D) Hollow Works</p> <p><b>Ans:D) Hollow Works</b></p>
5	208	<p>How many steps involved in Shigley's Design Process?</p> <p>(A) Ten    ( B) Six  (C) Four    (D) Three</p> <p><b>Ans:B) Six</b></p>

UNIT	Q NO	QUESTIONS
5	209	<p>In Shigley's design process, SYNTHESIS means ____.</p> <p>(A) preliminary ideas are developed      ( B) perception of a product  (C) design meet specification              (D) characteristics and performance</p> <p><b>Ans:A) preliminary ideas are developed</b></p>
5	210	<p>What is a major advantage of using CAD?</p> <p>(A) It requires less skilled operators      ( B) It is a slow process in design  (C) It increases productivity and              (D) It eliminates the need for design  accuracy    engineers</p> <p><b>Ans:C) It increases productivity and accuracy</b></p>
5	211	<p>In the 'Sequential Engineering' design process, each stage is completed:</p> <p>(A) In parallel                                      ( B) One after another in a sequence  (C) By the same person                          (D) In a random order</p> <p><b>Ans:B) One after another in a sequence</b></p>
5	212	<p>'Concurrent Engineering' involves:</p> <p>(A) A slow and steady design process      ( B) Overlapping design and development  phases to save time  (C) Only the design team working on      (D) A focus on individual tasks  a project</p> <p><b>Ans:B) Overlapping design and development phases to save time</b></p>
5	213	<p>What is the main goal of 'Value Engineering'?</p> <p>(A) To increase the cost of the              ( B) To improve the function of a product  product    while reducing its cost  (C) To use the most expensive              (D) To make the product look good,  materials    regardless of function</p> <p><b>Ans:B) To improve the function of a product while reducing its cost</b></p>
5	214	<p>The 'Lean Manufacturing' system primarily focuses on:</p> <p>(A) Maximizing waste                              ( B) Using as many resources as possible  (C) Minimizing waste and                          (D) Having a large inventory  maximizing value</p> <p><b>Ans:C) Minimizing waste and maximizing value</b></p>
5	215	<p>Sequential Engineering is often called as ____ method.</p> <p>(A) across the wall                                  ( B) boundary wall  (C) circular wall                                      (D) parallel wall</p> <p><b>Ans:A) across the wall</b></p>
5	216	<p>Concurrent Engineering is also called as ____.</p> <p>(A) Simultaneous Engineering              ( B) Structural Engineering  (C) Computer Engineering                      (D) Automotive Engineering</p> <p><b>Ans:A) Simultaneous Engineering</b></p>

UNIT	Q NO	QUESTIONS
5	217	<p>Concurrent Engineering is referred to as ____.</p> <p>(A) non parallel engineering                      ( B) parallel engineering  (C) process engineering                              (D) systematic engineering</p> <p><b>Ans:B) parallel engineering</b></p>
5	218	<p>DFMA stands for ____.</p> <p>(A) Design for Marketing and                      ( B) Design for Making and Arrangement  Addressing  (C) Design for Manufacturing and                      (D) Design for Modelling and Analysis  Assembly</p> <p><b>Ans:C) Design for Manufacturing and Assembly</b></p>
5	219	<p>Lean Manufacturing focuses on:</p> <p>(A) High inventory                                      ( B) Streamlined processes  (C) Increased downtime                              (D) Manual techniques</p> <p><b>Ans:B) Streamlined processes</b></p>
5	220	<p>Value Engineering optimizes the ____ of a product.</p> <p>(A) cost    ( B) availability  (C) property    (D) process</p> <p><b>Ans:A) cost</b></p>
5	221	<p>The process of creating a mathematical description of a 3D object is called:</p> <p>(A) Geometric Modelling                              ( B) Product Testing  (C) Market Analysis                                      (D) Financial Planning</p> <p><b>Ans:A) Geometric Modelling</b></p>
5	222	<p>CSG Stands for ____.</p> <p>(A) Commercial Sold Good                              ( B) Constructive Solid Geometry  (C) Combined Surface Generative                      (D) Conditional System Guidance</p> <p><b>Ans:B) Constructive Solid Geometry</b></p>
5	223	<p>Geometric models can be classified as ____.</p> <p>(A) Quantity and Quality model                      ( B) Planning and Processing model  (C) 2D drafting and 3D model                              (D) 4D drafting and 8D model</p> <p><b>Ans:C) 2D drafting and 3D model</b></p>
5	224	<p>Geometric modelling aids in:</p> <p>(A) Financial reports                                      ( B) 3D object simulation  (C) Video production                                      (D) Audio recording</p> <p><b>Ans:B) 3D object simulation</b></p>

UNIT	Q NO	QUESTIONS
5	225	<p>Solid modelling provides:</p> <p>(A) 2D outlines ( B) Realistic 3D structures</p> <p>(C) Simple sketches (D) Text documents</p> <p><b>Ans:B) Realistic 3D structures</b></p>
5	226	<p>Which one is not for representation for Three-dimensional (3D) model?</p> <p>(A) Wire frame model ( B) Surface model</p> <p>(C) Solid model (D) Organic model</p> <p><b>Ans:D) Organic model</b></p>
5	227	<p>Which of the following is a type of solid modelling approach?</p> <p>(A) Line Representation Geometry ( B) Surface Representation Geometry (SRG) (LRG)</p> <p>(C) Constructive Solid Geometry (D) Point Representation Geometry (PRG) (CSG)</p> <p><b>Ans:C) Constructive Solid Geometry (CSG)</b></p>
5	228	<p>Constructive Solid Geometry (CSG) creates complex objects by:</p> <p>(A) Drawing lines and arcs shapes using trigonometry operations ( B) Stitching surfaces together using Pythagoras theorem</p> <p>(C) Combining simple primitive shapes using Boolean operations (D) Manually defining all vertices and edges</p> <p><b>Ans:C) Combining simple primitive shapes using Boolean operations</b></p>
5	229	<p>Boundary Representation (B-rep) defines a solid by its:</p> <p>(A) Internal volume (length, width, thickness) ( B) Enclosing surfaces (faces, edges, and vertices)</p> <p>(C) Primitive shapes (square, rectangular, triangular) (D) Mass and density (low, medium, high)</p> <p><b>Ans:B) Enclosing surfaces (faces, edges, and vertices)</b></p>
5	230	<p>Which solid modelling approach is generally considered less ambiguous and more robust?</p> <p>(A) Wireframe Modelling (WM) ( B) Surface Modelling (SM)</p> <p>(C) Boundary Representation (B-rep) (D) 2D Drafting (2DD)</p> <p><b>Ans:C) Boundary Representation (B-rep)</b></p>
5	231	<p>What does 'FEA' stand for?</p> <p>(A) Finite Element Analysis ( B) Fast Engineering Application</p> <p>(C) Final Engineering Approval (D) Fictional Element Algorithm</p> <p><b>Ans:A) Finite Element Analysis</b></p>
5	232	<p>FEA is a numerical method used for:</p> <p>(A) Creating 3D models for evaluation and presentation under condition ( B) Simulating how a component or assembly behaves under various physical conditions</p> <p>(C) Generating manufacturing drawings with specification in detailed condition (D) Managing product data verification and analysing under various condition</p> <p><b>Ans:B) Simulating how a component or assembly behaves under various physical conditions</b></p>

UNIT	Q NO	QUESTIONS
5	233	Which modelling technique is best for creating photorealistic images? (A) Wireframe modelling ( B) Solid modelling (C) 2D drafting (D) Stick-figure drawing <b>Ans:B) Solid modelling</b>
5	234	Boolean operations in CSG include: (A) Draw, Trim, Extend ( B) Union, Intersection, Difference (C) Pan, Zoom, Rotate (D) Fillet, Chamfer, Shell <b>Ans:B) Union, Intersection, Difference</b>
5	235	Which stage is not defined for the Product life cycle? (A) Growth ( B) Maturity (C) Decline (D) Design <b>Ans:D) Design</b>
5	236	The main advantage of B-rep over CSG is its ability to: (A) Represent and easy to construct simpler objects ( B) less memory storage space is required (C) Non analytical and complicated surfaces can be created (D) Use Boolean operations easily <b>Ans:C) Non analytical and complicated surfaces can be created</b>
5	237	Prototyping reduces: (A) Design errors ( B) Production costs (C) Marketing time (D) Software bugs <b>Ans:A) Design errors</b>
5	238	The "Difference" or "Subtract" Boolean operation is used to: (A) Combine two objects into one ( B) Create an object that is the shared volume of two objects (C) Cut away one object's volume from another (D) Make two objects identical <b>Ans:C) Cut away one object's volume from another</b>
5	239	What type of elements are used in a B-rep model? (A) Frame elements ( B) Primitive shapes (C) Topological elements (D) Boolean operations <b>Ans:C) Topological elements</b>
5	240	'Rapid Prototyping' refers to: (A) Sketching ideas quickly on paper from IR ( B) Build physical models directly from CAD data (C) Testing a product rapidly from SCAN (D) Manufacturing a product quickly from UV <b>Ans:B) Build physical models directly from CAD data</b>

UNIT	Q NO	QUESTIONS
5	241	Representation of Solid models are superior to surface models because they contain: (A) Only surface information ( B) Volumetric information (C) Only edge information (D) Only colour information <b>Ans:B) Volumetric information</b>
5	242	What "primitives" are used as the solid objects of CSG? (A) An advanced, complex shape of objects ( B) cube, sphere, cylinder, cone (C) A hand-drawn sketch object (D) A final assembly object <b>Ans:B) cube, sphere, cylinder, cone</b>
5	243	Lean Manufacturing improves _____. (A) Waste production ( B) Operational efficiency (C) Design complexity (D) High inventory <b>Ans:B) Operational efficiency</b>
5	244	Which type of model represents an object using only lines and curves? (A) Solid model ( B) Surface model (C) Wireframe model (D) B-rep model <b>Ans:C) Wireframe model</b>
5	245	In FEA, a model is divided into a finite number of small 'elements', which are connected to each other at points called _____. (A) entity ( B) nodes (C) model (D) region <b>Ans:B) nodes</b>
5	246	Which of the following would be an application of CAD? (A) Writing an email ( B) Designing a car engine (C) Calculating company payroll (D) Creating a music playlist <b>Ans:B) Designing a car engine</b>
5	247	Constructive solid geometry approach is also called as _____. (A) house construct approach ( B) building block approach (C) wire construct approach (D) frame construct approach <b>Ans:B) building block approach</b>
5	248	Which one is not an FEA software? (A) CATIA ( B) ANSYS (C) ABAQUS (D) INTEL <b>Ans:D) INTEL</b>

**UNIT Q NO**

**QUESTIONS**

5 249 In solid model, C-rep means \_\_\_\_\_.

(A) Control Reproduce

( B) Connected Respect Service

(C) Constructive Solid Geometry

(D) Combined Scalar Graph

**Ans:C) Constructive Solid Geometry**

5 250 The best method for three-dimensional model construction is the \_\_\_\_\_.

(A) Hollow Modelling Techniques

( B) Solid Modelling Techniques

(C) Cartoon Drawing Techniques

(D) Decoration Model Techniques

**Ans:B) Solid Modelling Techniques**

**UNIT – 1**

**PART B** (Short answer questions each question carries 2 marks)

1. Name the engineering materials used in practice.
2. How malleable cast iron is designated? Give examples.
3. How a plain carbon is steel designated according to BIS?
4. How are preferred numbers used in engineering design?
5. Why factor of safety is necessary in mechanical engineering design?
6. Define the stress and its types.
7. What is a composite material?
8. What are the applications of composite materials?
9. Define creep. List the components subjected to creep.
10. What is endurance limit?
11. What is stress concentration?
12. What is S-N curve?
13. What is fatigue? What are the machine parts commonly affected due to fatigue?
14. What is stress concentration?
15. List out the theories of elastic failure applicable to machine parts.

**UNIT – II**

**PART B** (Short answer questions each question carries 2 marks)

16. What is a key? State its function.
17. Mention the different types of keys.
18. List out the types of sunk keys
19. Give the usual proportion of rectangular key.
20. What is woodruff key? Give its applications.
21. What are the types of failures in keys?
22. What is the effect of key way cut on a shaft?
23. What is the purpose of coupling?
24. What is the requirement of good coupling?
25. Name the types of flange coupling.
26. Differentiate unproductive type and protective type flange coupling.
27. What is the use of bushed pin type flexible coupling?
28. Find the width and thickness of sunk key suitable for a 60 mm diameter shaft.
29. A marine type coupling is used to transmit power of 65kW at 100 rpm. Find the torque.
30. In design of flange coupling, torque transmitted at 286500 N-mm and safe shear stress of 60 N/mm<sup>2</sup>. Find the standard diameter of shaft.

**UNIT – III**

**PART B** (Short answer questions each question carries 2 marks)

31. What are the different types of belts used in power transmission?
32. Mention the cross section of flat belt and V belt have.
33. List out the desired properties of belt materials.
34. Name the common materials used for manufacturing belts.
35. What is a ply in flat belt?
36. How balata belts are made?
37. State the types of belt drive.
38. Define speed ratio or velocity ratio.
39. Define slip and state its effect.
40. What is centrifugal tension?
41. Write the formula for ratio of belt tensions for flat belt and V belt.
42. Write the formula for power transmitted in belt drives.
43. How V belts are designated? Give an example.
44. Define pitch length of a V belt.
45. What does B1905 -54 denote in V – belts?

**UNIT – IV**

**PART B** (Short answer questions each question carries 2 marks)

46. Define bearing.
47. Differentiate the radial bearing and thrust bearing.
48. What is sliding contact and rolling contact bearing?
49. What is meant by full journal and partial journal bearing.
50. List out the common types of roller bearing.
51. How ball bearings are designated as per BIS? Give an example.
52. What are the properties of bearing materials?
53. Define diametral clearance ratio.
54. Define eccentricity ratio.
55. What are the short, square and long bearings?
56. What is the bearing characteristic number?
57. What are the purposes of lubrication in bearings?

58. A journal bearing 300 mm long and 150mm in diameter carries radial load of 9kN at 1200 rpm. Find the bearing pressure.
59. A full journal bearing with 60 mm diameter and a length of 75 mm rotates at 1450 rpm. Find the rubbing velocity.
60. Heat generated of journal bearing is 6275 J/s. The temperature is controlled by the flow of oil through the bearing. If the temperature difference between the outlet and inlet is 20°C and specific heat of oil is 1930 J/kg/°C, obtain the quantity of oil required.

**UNIT – V**

**PART B** (Short answer questions each question carries 2 marks)

61. Define CAD.
62. List out the roles of CAD in design.
63. Name the stages of product life cycle.
64. What is sequential engineering
65. What is concurrent engineering
66. What is value engineering?
67. What is lean manufacturing?
68. List out the advantages of lean manufacturing.
69. List out the major geometric modelling techniques.
70. What is Constructive Solid Geometry?
71. Name the primitives used in solid modelling.
72. What are the available Boolean operators in CSG?
73. How are geometric elements linked to the topological elements in B-rep?
74. What is FEA?
75. What is a prototype?

**UNIT – I****PART C** (Short answer questions each question carries 3 marks)

1. What are the factors that affect the selection of materials for the design of machine elements?
2. Name the type of steel and its composition to the following designation:  
XT72 W18 Cr4 V1
3. Define factor of safety for ductile and brittle materials.
4. Briefly explain the creep curve with three stages
5. Briefly explain the S-N Curve?
6. What are the remedies taken to reduce the stress concentration?
7. A knuckle joint is subjected to a pull of 115 kN. The fork end and the rod end are connected using a pin and its subjected to the double shear. Permissible shear stress of the pin is 60 N/mm<sup>2</sup>. Calculate the diameter of the pin.
8. A circular steel bar of 20 mm diameter carries a tensile load of 30kN. Find the tensile stress in the bar and the elongation in a length of 300 mm, if  $E = 2 \times 10^5$  N/mm<sup>2</sup>.
9. A hydraulic press exerts a total load of 3.5MN, which is carried by two steel rods of 2.5 m long supporting the upper head of the press. If the safe stress is 85 MPa. Calculate the diameter of the rod.
10. A steel rope of 100mm<sup>2</sup> cross sectional area is made up of strands (threads of rope) 1mm in diameter having an allowable tensile stress of 168 N/mm<sup>2</sup> and an ultimate strength of 130 kN. The factor of safety is 8. If the area of 10 broken strands is 7.854 mm<sup>2</sup>, find the calculated working stress, is the rope fit for further use?

**UNIT – II****PART C** (Short answer questions each question carries 3 marks)

11. How are the types of coupling classified?
12. Sketch a protective type flange coupling and indicate its various dimensions.
13. State the advantages of bushed pin type flexible coupling?
14. The standard cross section of a flat key, which is fitted on a 50 mm diameter shaft is 16 X 10 mm. The key is transmitting torque of 475 Nm from shaft to the hub. The allowable crushing stress for key material is 80 N/mm<sup>2</sup>. Determine the length of key required.
15. A pulley is connected to the 30 mm diameter of shaft by means of a key and the torque is transmitted at 425000 Nmm. Find the dimensions of the key so that the shear stress in the key does not exceed 50 MPa and length of the key is 4 times its width.
16. In a flange coupling, the diameter of the shaft is 30mm, Find the other dimensions: Thickness of the flange ( $t_f$ ), Length of the hub for each flange (L), Outer diameter of the hub (D) and Outer diameter of flange ( $D_o$ )

17. In a flange coupling the transmitted torque is 286500 Nmm. The outer diameter of the hub  $D = 60$  mm and the diameter of the shaft  $d = 30$  mm. Determine the induced shear stress ( $\tau_f$ ) in the hub material?
18. In a flange coupling with four bolts, the transmitted torque 286500 Nmm, pitch circle diameter of bolt  $d_p = 110$  mm and shear stress for bolt material is  $60 \text{ N/mm}^2$ . Find the standard diameter of bolt ( $d_b$ ).
19. A marine flange coupling is used to transmit power 2.7 MW at 90 rpm. with a working shear stress of  $63 \text{ N/mm}^2$ . Calculate the diameter of the shaft.
20. In a marine type flange coupling with eight bolts, the transmitted torque is 6200000 Nmm, pitch circle diameter of bolt  $d_p = 160$  mm and shear stress for bolt material is  $33 \text{ N/mm}^2$ . Find out the standard diameter of bolt ( $d_b$ ).

### UNIT – III

#### PART C *(Short answer questions each question carries 3 marks)*

21. Write short notes on belt materials.?
22. Sketch the open and cross belt drives with their notations and uses.
23. Sketch the cross section of V belt and label its important parts.
24. Compare the flat belt with V belt.
25. In a flat belt drive, the diameters of bigger and smaller pulleys are 840 mm and 280 mm. The centre distance between the pulleys is 1.68 m. Find the arc of contact of the belt in radians. [Assume an open belt drive]. Also, find the ratio of tension, if coefficient of friction is 0.2.
26. The diameters of driven pulley and driver pulleys are 1200 mm and 400 mm. The driver pulley rotates at 740 rpm. The centre distance between the pulleys is 3 m. Find the length of flat belt. [Assume cross belt drive] and the velocity of belt.
27. A leather flat belt transmits 22.5 kW power to an aluminium rolling machine. The arc of contact factor and the small pulley diameter correction factor are 1.064 and 0.9 respectively. Find the design power of belt  $P_d$  and assume the service factor for shock load.
28. The following data is available for V belt drive: Diameter of driven pulley = 500 mm, Diameter of driving pulley = 150 mm. Centre distance between the pulleys = 925 mm. Power transmitted = 7.5 kW. Find the standard value of pitch length ( $l_p$ ) of belt.
29. A compressor receives power from a motor rated at 7.5 kW and velocity 7.85 m/s by means of V belts. Small pulley diameter and diameter factor are  $d_1 = 150 \text{ mm}$   $k_d = 1.14$  per belt respectively. Calculate the power rating per belt  $P_b$ .
30. In B type cross section V-belt drive, the diameters of driving pulley and driven pulley are 150 mm and 500 mm. Find the (i) Outer and core diameter of driving pulley and (ii) Outer and core diameter of driven pulley, and (iii) Width of the pulley, if the number of the belt is 5.

## UNIT – IV

**PART C** (Short answer questions each question carries 3 marks)

31. How are bearing classified?
32. Sketch a ball rolling contact bearing and label its important parts.
33. Briefly explain bearing characteristic number with the graph plotted by Mckee's brothers.
34. A 50 mm diameter and 75 mm long journal bearing is loaded with bearing pressure of 2 MPa. The shaft in bearing rotates at 500 rpm. Find the heat generated [  $Q_g$  ] of the bearing. Take coefficient of friction  $\mu = 0.0015$ .
35. A journal bearing has a 50 mm diameter and is 75 mm long. Heat dissipated from the bearing is 14.75 J/s and heat is lost from the surface at the rate of  $11.6 \text{ J/m}^2/\text{s}/^\circ\text{C}$ . The housing area is 8 times the projected area. If the room temperature is  $28^\circ\text{C}$ , determine the surface temperature of bearing.
36. The coefficient of friction in a well lubricated journal bearing is 0.0063, the pressure is  $0.3333 \text{ N/mm}^2$  and it rotates at 600 rpm. Take  $D/C = 1000$  and correct end leakage factor  $k = 0.002$ . Find the viscosity of oil.
37. The mass flow rate of oil required for journal bearing of  $0.0036536 \text{ kg/s}$ , specific heat of oil is  $1720 \text{ J/kg/K}$  and heat generated by the bearing is  $93.556 \text{ J/s}$ . Find the increase in oil temperature [  $\Delta t_0$  ].
38. A suitable journal bearing for a centrifugal pump form the following data: Load on the bearing (P) =13.25 kN. Diameter (D) and Length (L) of bearing are 80 mm and 160 mm. The rubbing velocity is  $6.032 \text{ m/s}$  and coefficient of friction  $\mu = 0.0104$ . Assume a heavy construction bearing with  $K = 0.273^\circ\text{C}/\text{m}^2/\text{W}$  and  $\Delta t = 22.5^\circ\text{C}$ . Compare the heat generated and the heat dissipated for the bearing. What type of cooling is required for bearing?
39. The heat generated[  $Q_g$  ] and heat dissipated [  $Q_d$  ] of the journal bearing are  $480.665 \text{ J/s}$  and  $389.312 \text{ J/s}$ . Calculate the mass flow rate of oil required for artificial cooling, if the specific heat [ $C_p$ ] of oil  $1710 \text{ J/kg K}$  and temperature difference between outlet and inlet [  $\Delta t_0$  ] is  $10^\circ\text{C}$ .
40. A journal bearing 300 mm long and 150 mm diameter carries a radial load of 9 kN at 1200 rpm. The power lost in friction is 6 kW. Viscosity of oil at room temperature is  $0.018 \text{ Pa}\cdot\text{s}$ . Find the diametral clearance.

**UNIT – V**

**PART C**      (*Short answer questions each question carries 3 marks*)

41. Describe the role of CAD activities in Shigley's design process.
42. Write the important applications of CAD.
43. List out the advantages of CAD
44. Briefly explain the sequential engineering with diagram.
45. Briefly explain the concurrent engineering with diagram.
46. List out the techniques and advantages of lean manufacturing.
47. Compare CSG and B-rep.
48. State the advantages of solid modelling.
49. List out the three phases, advantages and application of Finite Element Analysis.
50. List out the major techniques used in New Product Development.