WINTER – 19 EXAMINATION

Subject Name: EME **Model Answer** Subject Code: 22342

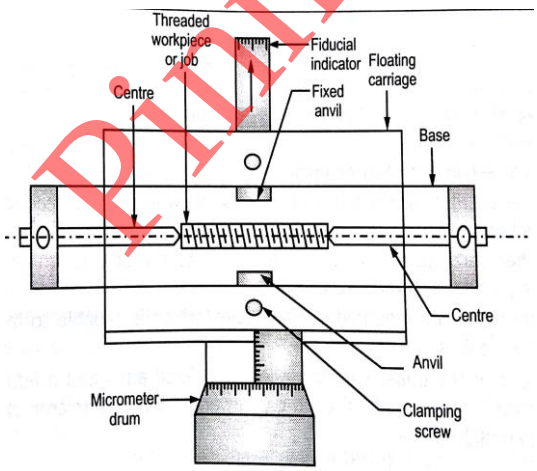
Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

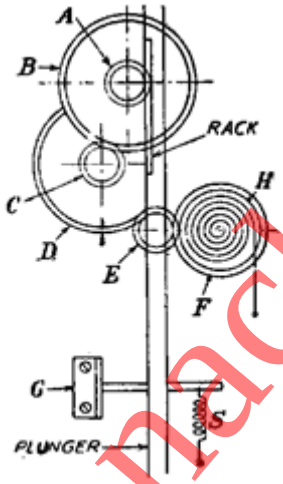
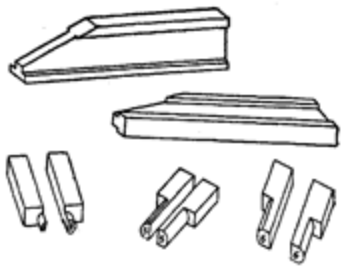
Q. No.	Sub Q. N.	Answer	Marking Scheme
Q.1	a)	Types of Metrology:- 1) Legal metrology 2) Scientific Metrology 3) Industrial metrology	01 Mark Each Any Two
	b)	Mechanical Comparator A)Dial Indicator B)Johansson Mikrokator C)Sigma Comparator D) Mechanical optical comparator *Any one sketch for 1M*	List 01 Mark Sketch OF ANY ONE 01 Mark
	c)	**Taylors Principle of Gauge design:-** 1) GO gauge should be designed to check the maximum material limit, while the NO-GO gauge should be designed to check the minimum material limit. 2) GO gauges should check all the related dimensions (roundness, size, location ect). Simultaneously whereas NO-GO gauge should check only one element of the dimension at a time.	01 Mark Each
	d)	Backlash error : Backlash is the play between the mating tooth surfaces i.e the distance through which a gear can be rotated to bring its non working flank in contact to the teeth of the mating gear. Run out error : It is the total range of the readings of a fixed indicator with contact point applied to a surface rotated , without axial movement about a fixed axis . Run out error is related to concentricity of gear outer diameter with mounting hole.	01 Mark Each

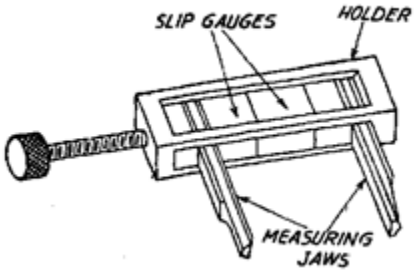
	e)	For Measuring acute angle and obtuse angle, For checking a 'V' block:	01 Mark Each
	f)	(i) Primary texture : Irregularities of small wavelength are called primary texture. These are generally caused due to cutting tools, friction, wear etc., it is also termed as roughness. (ii) Secondary texture : Irregularities of considerable wavelength are called secondary texture, also called as waviness. These are generally caused due to misalignments, non linear feed motions, generally due to problems in machine tools 	01 Mark Each
	g)	**Causes of surface roughness:-** Vibrations, material of the work piece, type of machining, rigidity of the system consisting of machine tool, fixtures, cutting tool and work, type form material and sharpness of the cutting tool, cutting conditions (speed, feed and depth of cut), type of coolant used	02 Mark Any Four
Q.2		**Attempt any THREE of the following**	
	a)	**Needs of the inspection in manufacturing industry:-** 1) To ensure that the part, material or a component confirms to the established standard. 2) To meet the interchangeability of manufacturer. 3) To maintain the customer relation by ensuring that no faulty product reaches the customer. 4) Provide the means of finding out shortcomings in manufacture. 5) It helps to purchase good quality of raw material, tools, equipment which governs the quality of the finished product. 6) It helps to coordinate the functions of quality control, production, purchasing and other departments of the organization. 7) To take decision on the defective parts.	01 Mark Each Any Four
	b)		01 Mark Each Any Four

Line Standard	End Standard
When length is express as distance between two parallel line is called line standard.	When length is expressed as distance between two parallel faces is called as end standard.
Measurement is quick and easy.	Measurement is time consuming.
It is not used for précised measurement.	It is used for précised measurement.
It is subjected to parallax error.	It is not subjected to parallax error.
It is not subjected to wear and tear.	It is subjected to wear and tear.
It is cheaper.	It is costlier.
It is simple in construction.	It is complicated in construction.
No skilled worker is required for measurement.	It is very accurate.
Less accurate.	More accurate
Ex. Scale, meter tape, yard.	Micro meter, Vernier, slip gauges

	c)	Meaning of $27H_5f_6$ Basic size is 27 mm. ---------- 01 Mark H type of hole with tolerance grade IT_5 ---------- 01 Mark F type of shaft with tolerance grade IT_6 ---------- 01 Mark Type of Fit :- Clearance Fit ---------- 01 Mark	
	d)	Principle :- • It works on principle of Nut and bolt/screw threads. • As drum of micrometer rotates by one revolution, it will move forward by one pitch of internal threads. • The movement will be measured using number of divisions on drum and main scale i.e. Micrometer principle. • It is used to measure major diameter, minor diameter and effective diameter of screw threads. -The floating carriage micrometer consists of a three units Fig. shows floating carriage micrometer . • It consists of two centers maintained on the pillars of base. • The centers are used for fixing the job. • The floating body (with zero friction) is kept on the base, which has two pillars on it. • One pillar consists of a micrometer drum having least count of 0.0002 mm. • The other pillar consists of fudicial indicator which senses the pressure applied on the anvil end.  **Floating carriage diameter measuring machine**	02 Mark Principle 02 Mark sketch
Q.3	a)	See table below	Any 04 points , 01 mark each

Accuracy	Precision
It is concerned with closeness to true value	Degree of repetitiveness
It is related to single measurement	It is related to group of measurement
It represents average of spread	It represents measure of spread
Various sources of error can affect accuracy	Various influences can affect accuracy

	b)	Least count = (smallest division on main scale) / (total no. of divisions on vernier scale) = 0.1/10 = 0.01 cm Total reading = (MSR) + (VSR* LC) = (2.6) + (7*0.01) = 2.67 cm	Calculations L.C 02 marks TR 02 marks
	c)	Mechanical comparator : it works on the principle of converting linear movement into angular using different mechanical linkages. It uses gears for magnification, scale pointer or digital display as indicating device. One of the most commonly used mechanical comparator is a dial indicator 	Working Principle 2 marks Sketch 02 marks
	d)	Hole basis / Shaft basis Hole size constant / Shaft size constant Represented by capital alphabets as per ISO system. / Represented by small alphabets as per ISO system Preferred for mass production / Preferred for special production Needs precise shaft manufacturing machines / Needs precise boring / hole manufacturing machines	Any 04 points , 01 mark each
Q.4	a)	Slip gauge accessories may listed as follows : 	Use 01 mark each Sketch 01 mark each any two



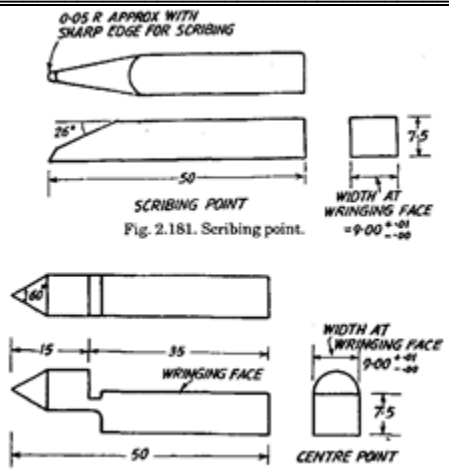


Fig. 2.181. Scribing point.

Measuring jaws and scribers are used for

1. Calibration of Vernier Caliper, Micrometer and Vernier Height gauge
2. For inspection in tool room and machine shops
3. Precision marking

b)

Given data

Shaft $30.00^{-0.005}_{-0.018}$

Hole $30.00^{+0.020}_{-0.000}$

$(UL)_{shaft}$ = 29.995

$(LL)_{shaft}$ = 29.982

$(UL)_{hole}$ = 30.020

$(LL)_{hole}$ = 30.000

Basic size Shaft = 29.982

Hole = 30.000

Shaft and Hole tolerance

Shaft tol = 29.995 - 29.982 = 0.013

Hole tol = 30.020 - 30.000 = 0.020

maximum clearance

$(UL)_{hole} - (LL)_{shaft}$

= 30.020 - 29.982

= 0.038

Minimum clearance

$(LL)_{hole} - (UL)_{shaft}$

= 30.000 – 29.995

= 0.0249

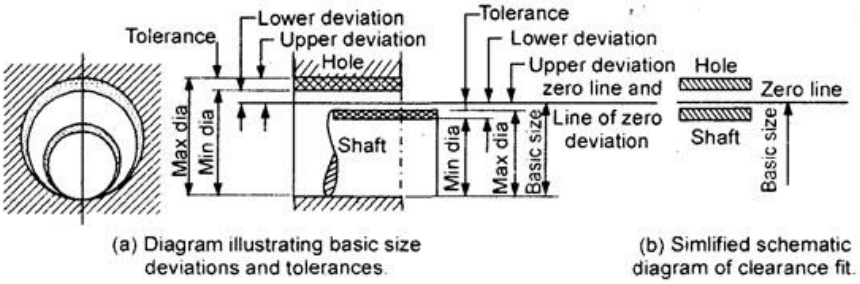
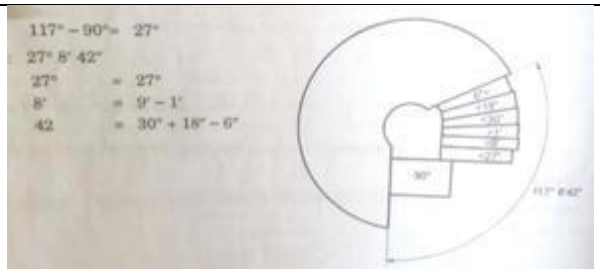
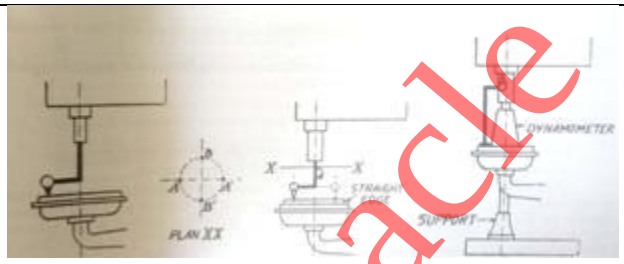
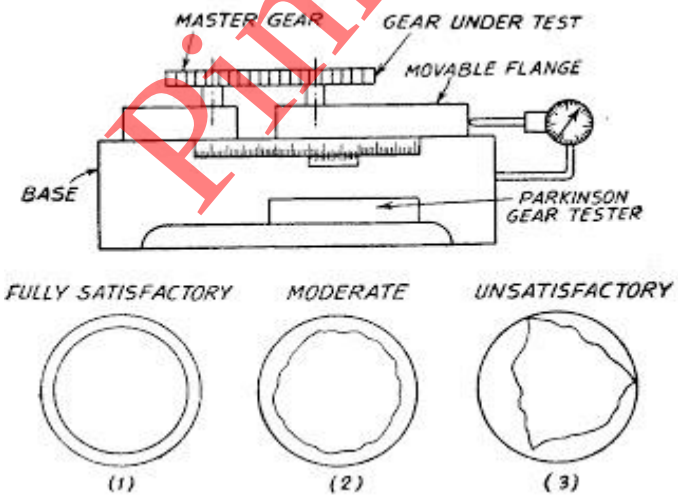
Basic size 01 ,

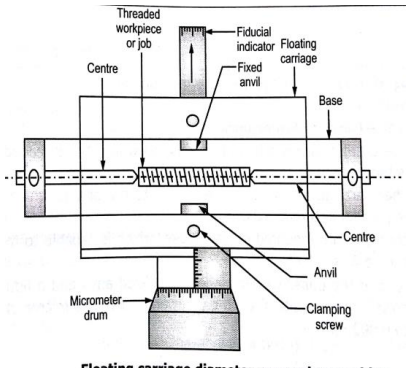
Tolerance 01,

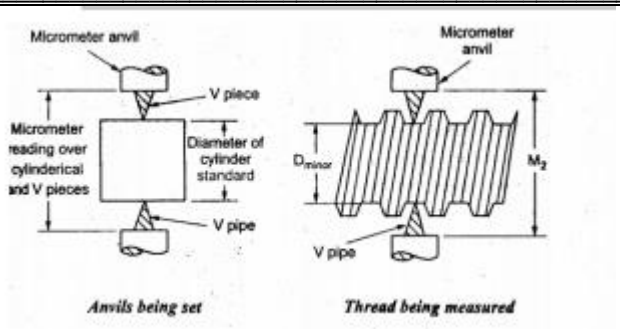
maximum clearance 01,

Minimum clearance 01

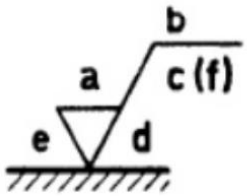
marks

	c)	 (a) Diagram illustrating basic size deviations and tolerances. (b) Simlified schematic diagram of clearance fit.	04 marks 01 for each
	d)		Calculations 02, sketch 02
	e)		Any of these sketch 04 marks
Q.5	a)	Parkinson's Gear Tester  The procedure of this Parkinson's gear tester is to mount a standard gear on a fixed vertical spindle and the gear to be tested on another similar spindle mounted on a similar spindle mounted on a sliding carriage, maintaining the gears in mesh by spring pressure. Movements of the sliding carriage as the gears are rotated and indicated by a dial indicator, and these variations are a measure of any irregularities in the gear under test , alternatively a recorder can be fitted , in the form of a waxed circular chart and records made of the gear variation in accuracy of mesh. The gears are mounted on the two mandrels , so that they are free to rotate without measurable clearance. The left spindle can be moved along the table and clamped in any desired position. The right mandrel slide is free to move, running on steel balls , against spring pressure	03 Marks for procedure and 03 Marks for Sketch

		and it has a limited movement. The two mandrels can be adjusted so that their axial distance is equal to the designed gear centre distance. When the waxed paper recorder is fitted, the chart makes a revolution for each one of the gears mounted on the sliding carriage. As the chart moves and rotates, the line traced records the movements of floating carriage. A circle is drawn at the same time as the record . ***(Parkinson's Gear Tester is used to measure gear attributes and it's rolling test ,and not used for measurement of gear tooth thickness. However If students attempts this question with above solution ,the procedure and sketch of it may be considered and then appropriate marks. ..considering 03 marks for sketch and 03 marks for explanation).****	
	b)	Measurement of minor diameter by using floating carriage micrometer: The minor diameter is measured by a comparative method by using floating carriage diameter measuring machine and small V pieces which make contact with the root of the thread. These V pieces are made in several sizes, having suitable radii at the edges. V pieces are made of hardened steel. The floating carriage diameter-measuring machine is a bench micrometer mounted on a carriage. **PROCEDURE :-** -A calibrated setting cylinder having nearly same diameter as the minor diameter of the thread to be measured is used as setting standard. -the setting cylinder is held between the V anvils and readings are taken. -the cylinder is then replaced by the threaded work piece and again the micrometer reading is noted. If , D= diameter of the setting cylinder, R1= reading of micrometer on setting cylinder. R2= reading of micrometer on screw thread. Then minor diameter of screw thread, = D ± (R2-R1)  Floating carriage diameter measuring machine	03 Marks Procedure 03 Mark For sketch



c)



a = Roughness value *Ra* in micrometres
or
= Roughness grade number N1 to N12.

b = Production method, treatment or coating
c = Sampling length
d = Direction of lay
e = Machining allowance
f = Other roughness values (in brackets).

03 Mark for sketch

03 Mark for labelling

Q.6 a)

Procedure :-

1.1 The given work piece is cleaned before taking measurement.

1.2 The fixed blade of the bevel protractor is made to coincide with the reference surface of work piece.

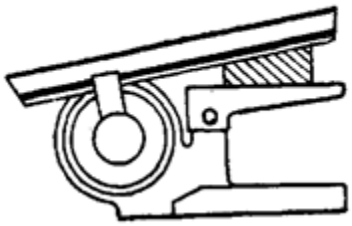
1.3 Move the movable blade of protractor to coincide with outer surface.

1.4 The angle between the blades is taken from protractor after noting main scale and vernier scale reading.

Angle between the faces is given by

A= main scale reading + L.C. x (Vernier scale reading)

Least Count of the Protractor= 5 minute.



If sine bar and slip gauge are used then it is also accepted

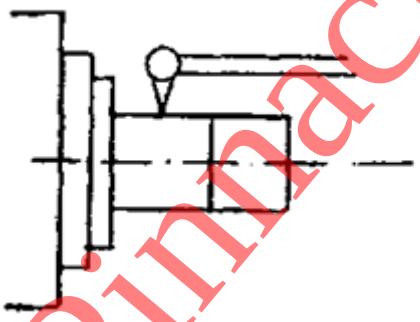
Procedure 04 Marks and Sketch 02 Marks

b)

Angle gauges	Slip gauges
(i) Angle gauges enables angle to be set to the nearest 3".	Slip gauges are universally accepted end standard of length in industry.
(ii) It has triangular in cross section.	It has rectangular in cross section.
(iii) The angle gauges are marked with engraved V which indicates the direction of the inclined angle which affects on addition and subtraction of angles.	The direction of slip gauges is not affected in addition and subtraction of dimension.
(iv) Angle gauges are available in 12 and 13 pieces set.	Slip gauges are available in M-45, M-87, M-112 and M-33/2.
(v) Any angle can built by adding and subtraction of angle gauges in combination with square block.	Any linear dimension can built by adding the combination of slip gauges.

1.5 Mark Each

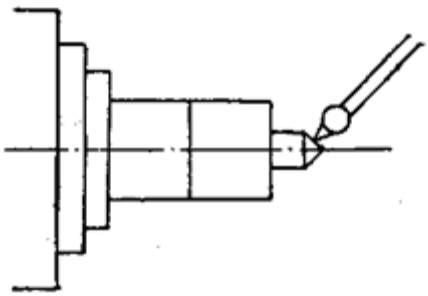
c) i)



True Running of lathe main spindle

03 Marks Diagram

ii)



Run out of Spindle

03 Marks Diagram