

FIRST YEAR KGCE EXAMINATION IN MECHANICAL ENGINEERING
MECHANICAL ENGINEERING-I (TRADE THEORY)

MODEL QUESTION PAPER – ANSWER KEY

(Time : 3 hours)

(Maximum Marks: 60)

PART-A

(Maximum Marks: 20x1 Marks = 20 Marks)

- I. Answer the following questions by choosing the correct answer from the options given below.
 Each question carries 1 mark.

Q No	Question	Answer
1	Property of a material which can be drawn into wire without rupture?	b) Ductility
2	Class of fire caused by burning paper, fire wood, cloth?	a) Class 'A' fire
3	What is the product obtained from blast furnace?	a) Pig Iron
4	Brass is an alloy of?	b) Copper+Zinc
5	Which file is used to make the job close to the finishing size?	c) Second cut file
6	Which caliper is used to mark the centre of a round bar?	a) Jenny caliper
7	Which type of taper is provided in the drill shank?	c) Morse taper
8	Which tool is used in sheet metal to scribe a circle or arc with large diameter?	b) Trammel
9	Which file is used for filing wood and leather?	c) Rasp cut file
10	Name the tool used for making fluid tight joint in riveting?	c) Fullering tool
11	Filler rod used in gas welding of stainless steel?	c) Columbium stainless steel
12	Which arc welding machine is preferred anywhere in the field work even away from electric lines?	c) Engine generator set
13	Which of the following factor determines the current setting during welding?	d) Diameter of electrode
14	Which one of the following is the type of transformer used in arc welding?	a) Step-down
15	Acetylene is the product of chemical reaction between calcium carbide and	b) Water
16	Which gauge is used to compare the profile of a thread?	d) Screw pitch gauge
17	What is the unit of cutting speed in turning?	c) m/min
18	The operation carried out in turning to remove burr and sharpness from the edge of the component?	b) Chamfering
19	What is the purpose of back gear unit in lathe/	a) Reduce the spindle speed

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20	Which one of the following lathe is suitable for mass production? a) Turret lathe b) Capstan lathe c) Both (a) & (b) d) Bench lathe	c) Both (a) & (b) (Turret lathe, Capstan lathe)

PART-B

(Maximum Marks: 8x5 Marks = 40 Marks)

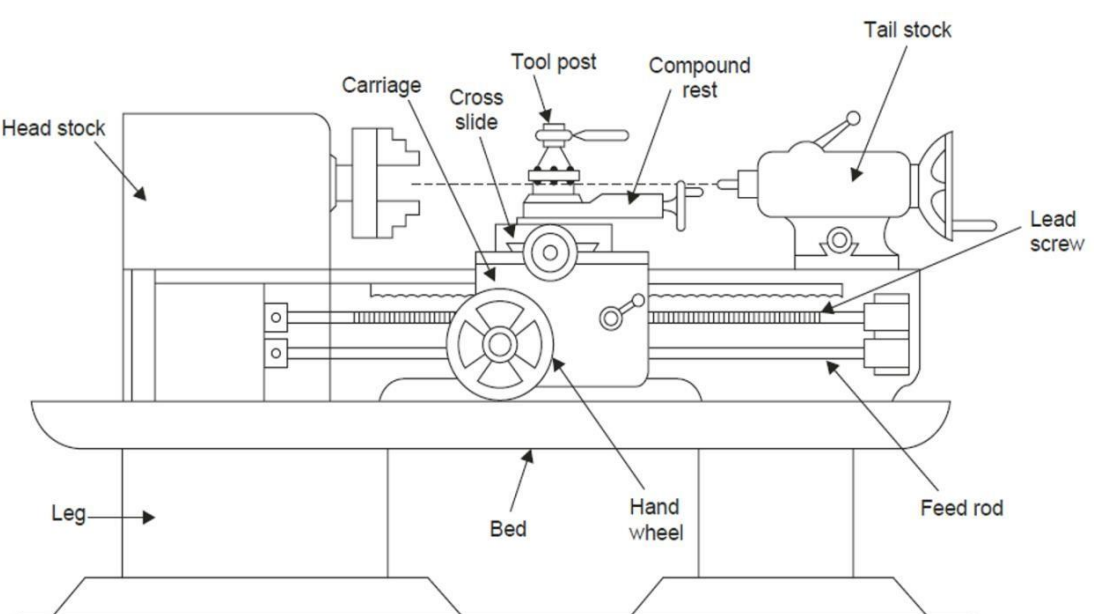
II. Answer *any eight* questions from the following. Each question carries marks.5 Marks.

Q No	Question		
1	<p>Differentiate between IC & EC engines?</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> <p><u>Internal Combustion (IC) engines:</u></p> <ul style="list-style-type: none"> - The combustion of the fuel takes place inside the engine cylinder. - The working fluid used may be petrol, diesel and various types of gases. - Requires less space compared to EC engines. - Capital cost is relatively low. - Starting of the engine is easy and quick - Thermal efficiency is high - Power developed per unit weight of engine is high - Light and compact in construction. - Cost of fuel is relatively high </td> <td style="width: 50%; padding: 5px;"> <p><u>External Combustion (EC) engines:</u></p> <ul style="list-style-type: none"> - The combustion of the fuel takes place outside the engine cylinder. - The working fluid used may be steam. - Requires more space compared to IC engines. - Capital cost is relatively high. - Starting of the engine requires time. - Thermal efficiency is low - Power developed per unit weight of engine is low - EC engine requires boiler and other components to transfer energy, thus is heavy. - Cost of fuel is relatively low </td> </tr> </table>	<p><u>Internal Combustion (IC) engines:</u></p> <ul style="list-style-type: none"> - The combustion of the fuel takes place inside the engine cylinder. - The working fluid used may be petrol, diesel and various types of gases. - Requires less space compared to EC engines. - Capital cost is relatively low. - Starting of the engine is easy and quick - Thermal efficiency is high - Power developed per unit weight of engine is high - Light and compact in construction. - Cost of fuel is relatively high 	<p><u>External Combustion (EC) engines:</u></p> <ul style="list-style-type: none"> - The combustion of the fuel takes place outside the engine cylinder. - The working fluid used may be steam. - Requires more space compared to IC engines. - Capital cost is relatively high. - Starting of the engine requires time. - Thermal efficiency is low - Power developed per unit weight of engine is low - EC engine requires boiler and other components to transfer energy, thus is heavy. - Cost of fuel is relatively low
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2	<p>List various safety practices and precautions to be followed for safe working in a shop floor?</p> <ul style="list-style-type: none"> - Wear safety shoes, tight clothes; beware of hanging hair, ties, clothing, scarves or belts getting caught. - Wear goggles whenever there is danger of flying matter. - Use right tools for right job. - Do not wear rings, watches, bracelets, necklace etc. that could be caught in moving parts. - Keep the floor clean of metal chips and waste pieces; passage should be clear, at all time to avoid accident. - Never operate the machine unless you have been properly instructed. - Never leave a machine when it is running. Never attempt to measure the job in running. - Never mount or remove the work, replace tools, clean or lubricate the machine, or remove the swarf, while the machine is running. - Be aware of the details and location of fire fighting devices like fire buckets, fire extinguishers etc. and first aid box in the workshop. 		

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3	<p>Explain different power transmission methods used in industry?</p> <p>Mechanical power transmission involves the transfer of power from one machine or system to other using mechanical components. Some of the common mechanical power transmission methods used in industries are:</p> <ol style="list-style-type: none"> 1. <u>Belt Drives:</u> Belt drives are one of the most common and popular mechanical power transmission methods used in industries. A belt drive consists of a flexible belt that is wrapped around two pulleys, one of which is connected to the power source (motor) and the other to the driven machine. In this system, the motor drives the pulley, which in turn drives the belt. The belt then transmits power to the driven machine through the second pulley. Belt drives are used in a wide range of applications, including conveyor systems, pumps, and fans. 2. <u>Chain Drives:</u> Chain drives are similar to belt drives, except that they use a chain instead of a belt to transmit power. A chain drive consists of a chain that is wrapped around two sprockets, one of which is connected to the power source (motor) and the other to the driven machine. Chain drives are used in applications that require high torque and heavy loads, such as industrial machinery and heavy equipment. 3. <u>Gear Drives:</u> Gear drives use gears to transmit power between two shafts. A gear drive consists of two or more gears that are meshed together, with one gear connected to the power source (motor) and the other to the driven machine. Gear drives are used in applications that require high precision and low backlash, such as machine tools and robotics. 4. <u>Couplings:</u> Couplings are mechanical devices used to connect two shafts and transmit power between them. A coupling consists of two hubs and a flexible element, such as a rubber or metal disc, that connects the hubs. Couplings are used in applications that require flexibility and shock absorption, such as pumps and compressors. 		
4	<p>List various hand tools used in fitting section and explain any 3 of them with neat figure?</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> <p><u>Measuring and marking tools:</u></p> <ul style="list-style-type: none"> - Steel rule - Try Square - Punches - Calipers - Dividers - Surface Gauge - Angle plate - Bevel square - Surface plate - Vernier caliper - Vernier height gauge - V block - Straight edge </td> <td style="width: 50%; padding: 5px;"> <p><u>Cutting, Striking & Holding tools:</u></p> <ul style="list-style-type: none"> - Files - Hacksaw - Chisels - Hammers - Vices </td> </tr> </table>	<p><u>Measuring and marking tools:</u></p> <ul style="list-style-type: none"> - Steel rule - Try Square - Punches - Calipers - Dividers - Surface Gauge - Angle plate - Bevel square - Surface plate - Vernier caliper - Vernier height gauge - V block - Straight edge 	<p><u>Cutting, Striking & Holding tools:</u></p> <ul style="list-style-type: none"> - Files - Hacksaw - Chisels - Hammers - Vices
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5	<p>Explain different filing methods?</p> <p>Filing is required after chipping or cutting operation to remove burr and clean the face of the cuts and finish the final shape of the work piece</p> <p><u>CROSS FILING:</u> It is the most common method of filing. Cross filing is carried out across two diagonals, to produce medium surface finish. It is used when large amounts of metal are to be removed. By cross filing ‘rounding’ the surface is reduced.</p> <p><u>STRAIGHT FILING:</u> When a short length of work piece is required to have a flat surface, straight filing is used. File marks made during cross filing may be removed, to produce a relatively smooth surface</p> <p><u>DRAW FILING:</u> It is done to get a finely finished surface. It produces a smoother surface finish than straight filing. A smooth or dead smooth flat file is used for this.</p> <p><u>FILING INTERNAL CURVES:</u> A part of half round file only makes contact as shown during filing operation. Movement of the file is indicated by arrows</p>
6	<p>List various stakes used in sheet metal workshop and explain any one of them with neat figure?</p> <p>Stakes are the sheet metal worker’s anvil used for bending, seaming or forming operations, using mallet or hammer.</p> <p>Different types of stakes are:</p> <ul style="list-style-type: none"> - Hatchet stake - Half moon stake - Funnel stake - Creasing stake - Planishing stake - Beak horn (bick iron) stake - Copper smith stake - Conductor stake - Horse stake
7	<p>Define coating factor and state the system of electrode coding?</p> <p><u>Coating Factor:</u> The ratio of the coating diameter to the core wire diameter is called the coating factor.</p> <p>As per IS 815-1974, the coding of an electrode shall consists of a prefix letter, a code number of six digits in numerals and in some cases one or more suffix letters each indicating a specific characteristic of the electrode.</p> <p style="text-align: center;">Eg. E 316413 J</p> <p><i>Prefix letter shows the method of manufacturing:</i></p> <ul style="list-style-type: none"> - E – Solid extrusion - R – Extruded with reinforcement <p>1st digit – stands for type of covering</p> <p>2nd digit – stands for welding position</p> <p>3rd digit – welding current condition and polarity</p> <p>4th & 5th digit – tensile strength and yield stress of the deposited metal.</p> <p>6th digit – min percentage elongation in combination with the impact value of deposited metal.</p>

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	<p><i>Suffix letters shows special property:</i></p> <ul style="list-style-type: none"> - J, K, L – iron powder covering and corresponding % of metal recovery - P – deep penetration
8	<p>Differentiate between straight and reverse polarity?</p> <div style="display: flex; justify-content: space-between;"> <div style="border: 1px solid black; padding: 5px; width: 48%;"> <p><u>Straight Polarity:</u></p> <ul style="list-style-type: none"> - Electrode is connected with the negative terminal of the power source and base metals are connected with the positive terminal - 2/3rd of the total arc heat is generated near base plate and rest is generated at electrode tip. - Proper fusion of the base metal can be achieved easily. So it eliminates the lack of fusion and lack of penetration defects - In case of consumable electrodes, filler metal deposition rate is quite low. - Arc voltage and arc stability does not depend on work material emissivity. - Arc cleaning action (oxide cleaning) is poor. - Inclusion defects may arise if base plate surfaces are not cleaned properly prior to the welding. - Not suitable for welding thin plates. - Metals with high melting temperature (such as stainless steel, titanium) can be suitably joined </div> <div style="border: 1px solid black; padding: 5px; width: 48%;"> <p><u>Reverse polarity:</u></p> <ul style="list-style-type: none"> - Base metals are connected with the negative terminal of the power source and electrode is connected with the positive terminal - 2/3rd of the total arc heat is generated at electrode tip and rest is generated near base plate. - Due to less heat generation near base plate, incomplete fusion of the base plate may occur. - Filler metal deposition rate is quite high as greater portion of heat is generated at electrode tip. - Arc voltage and arc stability significantly depend on work material emissivity. - Arc cleaning action is good. - Due to good arc cleaning action, tendency of inclusion defects reduces. - Suitable for welding thin plates - Metals with low melting temperature (such as copper, aluminum) can be suitably joined by DCSP. </div> </div>
9	<p>Explain the need of edge preparation in welding and types of edge preparation methods?</p> <p>The edge preparation is necessary to:</p> <ul style="list-style-type: none"> - Achieve the good quality welds. - Reduce welding time - Get the joint as strong as base metal - Reduce the cost of the welded joint <p>There are two main steps of edge preparation,</p> <ol style="list-style-type: none"> a) cleanliness of faying surface b) cutting of faying surface of base metal to be welded by fusion arc welding process <p>Plates having thickness less than 5mm do not require beveling of edges whereas plates having thickness between 5 to 12mm, should be beveled to form a single -V, single or double-U, or J-groove. The butt joint may be square butt, single-V, double-V, single-U, double-U, single-J, double-J etc. based on the type of joint required.</p>

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10	<p>Show different parts of a centre lathe with a neat sketch?</p> 
11	<p>List various accessories used in a lathe and state their applications?</p> <p>Lathe accessories are used for holding and supporting the work during lathe operations.</p> <ol style="list-style-type: none"> 1. <u>Work holding accessories</u> : <ul style="list-style-type: none"> - Chucks : for holding work piece in lathe. They are 4 jaw, 3 jaw and magnetic - Face plates : a circular disc with slots, used to hold large, flat, irregular shaped work pieces which cannot be held between centres or by chucks. - Mandrels : used to hold hollow circular jobs. 2. <u>Work supporting accessories</u>: <ul style="list-style-type: none"> - Lathe centres: To hold the work piece from ends which is having a centre drilled hole at both ends. - Catch plates : Either screwed or bolted to the nose of the head stock spindle to hold the carrier or lathe dogs. - Carriers/Dogs : They are mounted on the catch plate and used to transmit rotary motion from a faceplate to the work piece. - Steady rest : Used to support a long slender work, at some time intermediate point to prevent bending due to its own weight and cutting force acting in it. - Follower rest : Same as steady rest, but fitted to the saddle of the lathe as it follows the tool, it gives support just behind the cutting point.
12	<p>Explain various taper turning methods used in a lathe?</p> <ol style="list-style-type: none"> 1. <u>Form tool method</u>: In this method, a broad form tool with a straight cutting edge is set to the work at a half taper angle & is fed directly into the workpiece. The tool used in this method is called the taper turnings form tool. The tool itself is used in a tapered shape, creating a tapered workpiece. 2. <u>Tail stock set over method</u>: This method is commonly used when the angle of the tapers is very small. In this method, the axis of rotation of the workpieces is shifted to the axis of the lathe at half an angle to the taper. The tailstock is moved upright in a cross direction that

Q No	Question
	<p>is in the direction of the lathe axis by the turning set-over method</p> <p>3. <u>Compound rest method:</u> This method is typically used to produce short and steep cones. In this method, the compound rest is rotated at the required angle and held in position. The compound rest can be rotated up to 45 degrees.</p> <p>4. <u>Taper turning attachment:</u> In this method, the taper bend is performed using an attachment. This attachment has a guide bar, & this guide bar is usually placed in the center. The guide bar can swing at any required angles of the taper. The tool moves parallels to the guide bar.</p>