S5 MECHANICAL

QUESTION BANK

Questions Compiled by

DEPARTMENT OF MECHANICAL ENGINEERING

VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY-TECHNICAL CAMPUS

SUB CODE ME301 SUBJECT NAME MECHANICS OF MACHINERY

MODULE 1

1. What is meant by kinematic pairs?
2. Explain Geneva mechanism?
3. Explain the concept of mechanical advantage.
4. Define the terms: Kinematic Inversion, Inversion
5. Write a short note on Kutzbach Criterion
6. Sketch and explains Watts Straight line mechanism
7. What do you mean by Scott-Russel mechanism for tracing a straight line?
8. Define Grashof's law.
9. What are the types of automobile steering gear? Deduce the fundamental equation of steering gears.
10. Explain the working of Geneva mechanism with help of a neat sketch.
11. Sketch and explain slider two inversion of a double crank chain
12. State and explain Grashoff's law
13. Sketch and explain any one of the straight line mechanism
14. Explain concept of Mechanical advantage
15. Explain quick return Mechanism?

MODULE 2

1. Deduce the expression for the velocity and acceleration of the follower when it moves with cycloidal motion
2. Deduce the expression for velocity of sliding in a gear drive.
3. What is the importance of pressure angle in the design of cam profiles?
4. A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below :
   1. To raise the valve through 50 mm during 120° rotation of the cam ;
   2. To keep the valve fully raised through next 30°;
   3. To lower the valve during next 60°; and
   4. To keep the valve closed during rest of the revolution i.e. 150° ;

   The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when (a) the line of stroke of the valve rod passes through the axis of the cam shaft, and (b) the line of the stroke is offset 15 mm from the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m.
5. Draw a cam profile to drive an oscillating roller follower to the specifications given below :
   (a) Follower to move outwards through an angular displacement of 20° during the first 120° rotation of the cam ;
   (b) Follower to return to its initial position during next 120° rotation of the cam ; (c) Follower to dwell during the next 120° of cam rotation. The distance between pivot centre and roller centre = 120 mm ; distance between pivot centre and cam axis = 130 mm ; minimum radius of cam = 40 mm ; radius of roller = 10 mm ; inward and outward strokes take place with simple harmonic motion.
6. Construct the profile of a cam to suit the following specifications : Cam shaft diameter = 40 mm ; Least radius of cam = 25 mm ; Diameter of roller = 25 mm; Angle of lift = 120° ; Angle of fall = 150° ; Lift of the follower = 40 mm ; Number of pauses are two of equal interval between motions.

   During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the centre of the cam.

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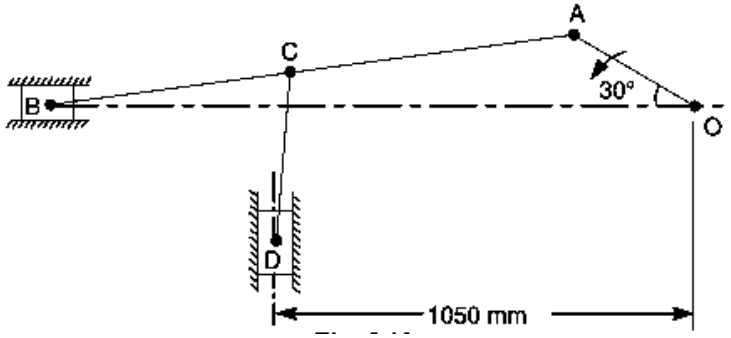
7 It is required to set out the profile of a cam to give the following motion to the reciprocating follower with a flat mushroom contact face :

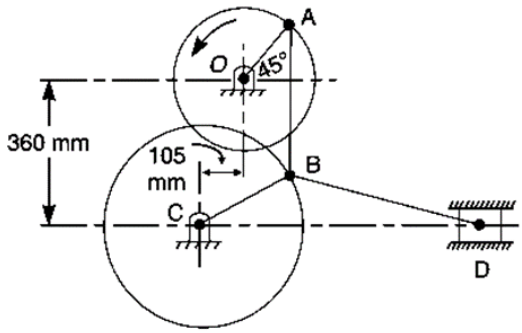
(i) Follower to have a stroke of 20 mm during 120° of cam rotation ;
(ii) Follower to dwell for 30° of cam rotation ;
(iii) Follower to return to its initial position during 120° of cam rotation ; and
(iv) Follower to dwell for remaining 90° of cam rotation.

The minimum radius of the cam is 25 mm. The out stroke of the follower is performed with simple harmonic motion and the return stroke with equal uniform acceleration and retardation.

8 In the mechanism, as shown in Fig., the crank OA rotates at 20 r.p.m. anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are OA = 300 mm; AB = 1200 mm; BC = 450 mm and CD = 450 mm.
Fig. 8.12 For the given configuration, determine : 1. velocities of sliding at B and D, 2. angular velocity of CD, 3. linear acceleration of D, and 4. angular acceleration of CD



9 In the toggle mechanism shown in Fig., the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter-clockwise direction at a speed of 180 r.p.m. increasing at the rate of 50 rad/s2. The dimensions of the various links are as follows:
OA = 180 mm ; CB = 240 mm ; AB = 360 mm ; and BD = 540 mm. For the given configuration, find 1. Velocity of slider D and angular velocity of BD, and 2. Acceleration of slider D and angular acceleration of BD.



10 A mechanism of a crank and slotted lever quick return motion is shown in Fig. If the crank rotates counter clockwise at 120 r.p.m., determine for the configuration shown, the velocity and acceleration of the ram D. Also determine the angular acceleration of the slotted lever.
Crank, AB = 150 mm ; Slotted arm, OC = 700 mm and link CD = 200 mm.

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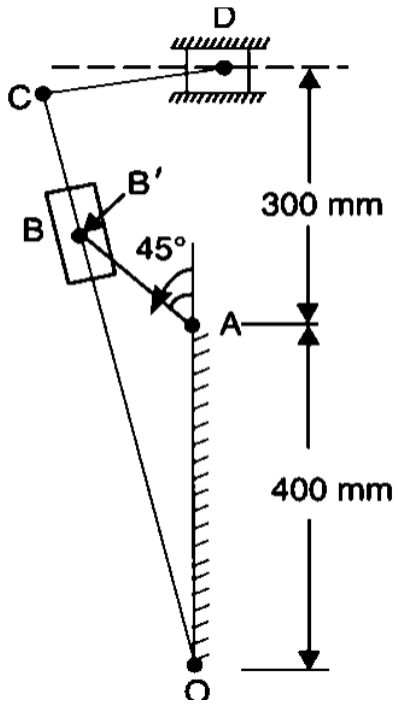

MODULE 3

1 A flat faced mushroom follower is operated by a uniformly rotating cam. The follower is - raised through a distance of 25 mm in l20^o rotation the cam, remains at rest for the next 30^o and is lowered during further I20^o rotation of the cam. The raising of the follower takes place with cycloidal motion and the lowering with uniform acceleration and deceleration- However, the uniform acceleration is 2/3 of the uniform deceleration. The least radius of the cam is 25 mm which rotates at 300 rpm.

Draw the cam profile and determine the values of the maximum velocity and maximum acceleration during rising, and maximum velocity and uniform acceleration and deceleration during lowering of the follower

2 It is required to set out the profile of a cam to give the following motion to the reciprocating follower with a flat mushroom contact face :

(i) Follower to have a stroke of 20 mm during 120° of cam rotation ;
(ii) Follower to dwell for 30° of cam rotation ;
(iii) Follower to return to its initial position during 120° of cam rotation ; and
(iv) Follower to dwell for remaining 90° of cam rotation.

The minimum radius of the cam is 25 mm. The out stroke of the follower is performed with simple harmonic motion and the return stroke with equal uniform acceleration and retardation.

3 A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below :

1. To raise the valve through 50 mm during 120° rotation of the cam ;
2. To keep the valve fully raised through next 30°;
3. To lower the valve during next 60°; and

4. To keep the valve closed during rest of the revolution i.e. 150° ;

The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when (a) the line of stroke of the valve rod passes through the axis of the cam shaft, and (b) the line of the stroke is offset 15 mm from the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m.

4 A tangent cam with straight working faces tangential to a base circle of 120 mm diameter has a roller follower of 48 mm diameter The line of stroke of the roller.follox.er passes through the axis of the cam. The nose circle radius of the cant is I2 mm and the angle between the tangential faces of the cam is 90˚ If the speed of the cam is 180 rpm, determine the acceleration of the follower when

1. During the lift, the roller just leaves the straight flank
2. The roller is at the outer end of its lift, i.e., at the top of the nose

5 A tangent cam with a base circle diameter of 50 mm operates a roller follower 20 mm in diameter The line of stroke of the roller follower passes through the axis of the cam. The angle between the tangential faces of the cam is 60˚ speed of the cam shaft is 200 rpm and the lift of the follower is l5 mm. Calculate

1. the Main dimensions of the cam
2. Acceleration of the follower at

(a) the beginning of lift
(b) where the roller just touches the nose
(c) the apex of the circular nose

6 The following data relate to a circular cam operating a flat-faced follower

Least diameter = 10 mm
Lift = 12 mm
Angle of action : I60˚
Speed = 500 rpm

If the period of acceleration of the follower is 60˚ to the retardation during the lift, determine the
(i) main dimensions of the cam
(ii) acceleration at the main points
what is the maximum acceleration and deceleration during the lift

7 The following data relate to a symmetrical circular cam operating a flat-faced follower

Minimum radius of the cam = l0 mm
Lift = 24 mm
Angle of lift = 75˚
Nose radius = 8 mm
Speed of the cam = 420 r.p.m

Determine the main dimensions of the cam and the acceleration of the follower at the
(i) beginning of the lift
(ii) end of contact with the circular flank
(iii) beginning of contact with the nose
(iv) apex of nose

MODULE 4

1 Give the classification of gears
2 With the help of a sketch, explain an epicycle gear train?
3 With the help of a neat sketch, explain Cam terminology
4 .What is interference in gears?
5 Define the following terms in gear: Diametrical Pitch, Dedendum, Module, Gear ratio
6 Explain different types of gears trains?
7 Describe herringbone gear?

8 What is meant by law of gearing?

9 What is meant by addendum and Dedendum?

10 Two involute gears in mesh have 20˚ pressure angle. The gear ratio is 3 and the number of teeth on the pinion
is 24 The teeth have a module of 6 mm. The pitch line velocity is 2.5 m/s and the addendum equal to one module,
Determine the angle of action of the pinion and the maximum velocity of sliding.

11 The involute gears in a mesh have a module of 8 mm and a pressure angle of 20˚. The larger gear has 57 while
the pinion has 23 teeth. If the addenda on pinion and gear wheels are equal to one module find the
✓ contact ratio (the number of pairs of teeth in contact)
✓ angle of action of the pinion and the gear wheel
✓ ratio of the sliding to rolling velocity at the
(a) beginning of contact
(b) pitch point
(c) end of contact

12 The following data relate to two meshing involute gears:
Number of teeth on the gear wheel : 60
Pressure angle : 20
Gear ratio: 1.5
Speed of the gear wheel : 100 rpm
Module = 8 mm
The addendum on each wheel is such that the path of approach and the path of recess on each side are 40% of the
maximum possible length each. Determine the addendum for the pinion and the gear and the length of the arc of
contact.

MODULE 5

1 An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels; D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft A co-axial with F. If the wheels have the same pitch and the shaft A makes 800 r.p.m., what is the speed of the shaft F ? Sketch the arrangement

2 Explain different types of gears trains?

3 What is meant by addendum and Dedendum

4 What is interference in gears?

5 The centre distance between two spur gears in a mesh is to be approximately 275 mm The gear ratio is I0 to 1.
The pinion transmits 360 kW at I800 rpm. The pressure angle of the involute teeth is **20**˚ and the addendum is equal
to one module. The limiting value of normal tooth pressure is 1 kN/mm of width. Determine the
(i) nearest standard module so that interference does not occur,
(ii) number of teeth on each gear wheel, and
(iii) width of pinion.

6 A pinion of **20**˚ involute teeth rotating at 275 rpm meshes with a gear and provides a gear ratio of l.8 The
number of teeth on the pinion is 20 and the module is 8 mm. If the interference is just avoided, determine

i) the addenda on the wheel and the pinion
ii) the path of contact,
iii) the maximum velocity of sliding on both sides of the pitch point.

MODULE 6

1 Derive Freudenstien's equation for three precision point synthesis of a four bar mechanism.

2 The crank of a quick return motion mechanism of crank and slotted lever type rotates at 50 rpm. The ratio of the maximum velocities is 2. The length of stroke is 30cm, find i) the length of slotted lever, ii) the ratio of the times of cutting and return stroke, iii) the maximum cutting velocities.

3 Describe briefly with the help of neat sketches, the inversion of the single slider crank chain. Mention the Applications of each of these inversion.

4 Synthesize of four bar mechanism that will in one of the positions satisfy the following values of angular velocities and acceleration $Y=X1.1\ 1\leq X\leq 5$
Use Chebyshev spacing for three precision points
Take $\varphi 0=30°$, $\psi 0=60°$ and $\Delta\varphi=\Delta\psi=90°$.and $\gamma=10$ cm.

5 Synthesise 4 bar linkage to generate $Y=\log 10\ X$ in the interval $1\leq X\leq 10$. The crank length is to be 5 cm the input crank is to rotate from 45 to 105 while the output crank moves from 135 to 225. Use the three precession points with Chebyshev's spacing.

6 Synthesize a four bar mechanism to generate a function = sin x. for $\theta\leq X\leq 90o$. The range of output crank may be chosen as 60o, while that of input crank be 120°. Length of fixed link is 52.5 mm and $\varphi 1=105°$ and $\psi 1=66°$

7 Design a four bar mechanism to generate a function Y=log X is to be generated $1\leq X\leq 2$. Use three precisions points. Length of fixed link =50 mm the range of the output crank is 60°and that of input crank is 120°

SUB CODE ME301 SUBJECT NAME MECHANICS OF MACHINERY

SUB CODE: ME303 SUBJECT NAME: MACHINE TOOLS AND DIGITAL MANUFACTURING

MODULE 1

1. Differentiate between orthogonal and oblique cutting. KU(Sep 2014)
2. Explain with sketches tool nomenclature and tool angles of a single point cutting tool. KU(Nov 2014)
3. Explain various factors affecting the cutting tool life. KU(Sep 2014)
4. Illustrate with merchant circles diagram determine the relationship between cutting forces and angles. KU(Nov 2014)
5. Explain various types of chips formed during machining operation with simple sketches. KU(Sep 2014)
6. What are the objectives of machine tool explain the various elements.
7. Name the tool materials commonly used for metal cutting. Briefly describe the properties and application of any two of them. KU(Nov2014)
8. Draw three views of a single point cutting tool and mark cutting angles used in tool signature
9. What is meant by high efficiency range of cutting speed? With the help of graph explain how it is obtained.
10. Define tool signature. How is it related to tool geometry?
11. Clearly explain the utility of Merchant's Circle Diagram. How it can be plotted?

MODULE 2

1. Describe the taper turning attachment on a lathe. What are its merits and demerits over other methods of taper turning
2. What are the attachments used on a Centre lathe what purpose do they serve. KU(Sep 2014)
3. With neat sketch explain the Apron mechanism of Lathe. KU(Sep 2014)
4. Draw the figure of a centre lathe and briefly explain the various parts of a lathe.
5. With a neat sketch the working principle of a lathe
6. Explain the classification of lathes
7. What are the different work holding devices in a lathe. KU(Sep 2014)
8. What is drilling- What is the tool used for drilling.
9. Explain the working of a drilling machine the help of a neat sketch. KTU(SEP 2016)
10. Draw a neat sketch of carriage of a lathe and write the functions of each part.
11. Name any three operations which can be carried out in lathe with tool held in tailstock.
12. With a neat sketch, explain various operations performed in drilling machine.
13. Differentiate between twist drill and straight flute drill.
14. Discuss the relative merits and demerits of the different methods for machining external taper on lathe.

SUB CODE: ME303 SUBJECT NAME: MACHINE TOOLS AND DIGITAL MANUFACTURING

MODULE 3

1. Draw a neat sketch and explain the principal parts of a shaper.
2. Draw a neat sketch of a plain milling cutter and explain it in detail.
3. Find the gear combination and indexing movement necessary
4. Explain with the help of a neat sketch the angular cutting operation
5. What are the differences of travelling head shaper from other shapers?
6. Which are the different types of planer machines? Explain any TWO with its special uses.
7. Draw a plain milling cutter and mark its parts and angles. Write the functions of each part and angles.
8. Differentiate between upmilling and down milling with sketches.
9. Which are the different milling operations? Explain any two with figures.
10. What is the reason behind generation of vibration in milling which affect the force system and reduces finish and tool life.
11. Compare and contrast (differentiate) shaping machine, slotting machine and planing machine.

MODULE 4

1. What are the various types of milling cutters? Give the sketches of a profile of sharpened milling cutter and mark all the element of cutter. KU(Sep 2014)
2. Explain with suitable example the simple indexing method. How it differ from Differential indexing. KU(Sep 2014
3. What is the reason behind generation of vibration in milling which affect the force system and reduces finish and tool life.
4. With the help of simple sketches, explain any three common attachments used in Milling Machines.
5. Show that the mean cross-sectional area of chip in plain milling is given by = ; Where f = feed in mm/m; N = cutter rpm; D = milling cutter diameter; d = depth of cut; m = No of tooth in cutter; W = Width of work piece.
6. Estimate the machining time that will be required to finish a vertical flatsurface of length 120 mm and depth 15 mm by an 8 teeth HSS end millcutter of 32 mm diameter and 60 mm length in a milling machine. Assume, cutting velocity = 30 m/min, feed = 0.12 mm/tooth.

MODULE 5

1. Explain with sketches external centreless grinding and internal centreless grinding operation. KU(Nov 2014).
2. List out the advantages & disadvantages for vitrified and silicate
3. Draw a neat sketch and explain any three types of locating devices
4. Compare grinding, lapping and honing process.
5. What is the cutting tool used for performing the grinding operation on what factors the cutting tool selection is made in the case of grinding
6. What is lapping. What are its advantages
7. A grinding wheel is specified by W A40 L4 V18. What is the meaning of each term included in it?

8 Name different types of centerless grinding. Explain working of any one type with figure.

MODULE 6

1 Define digital manufacturing. Explain its concept with help of diagram.
2 Write Three important features of digital manufacturing.
3 In digital manufacturing which are the objects those need to be described by a model
4 How bionic mechanics support to form DM science.
5 Which are the activities in GRAI network? Draw the charts which describe these activities
6 What is IDEF
7 With the help of a suitable illustration explain the concept of Digital Manufacturing.
8 With the help of a block diagram explain the Architecture of Digital Manufacturing System.
9 Briefly outline the system modelling principle, modelling methods and modelling steps followed to create an abstract model of the digital manufacturing system.
10 Formulate the general mathematical model of the digital manufacturing system.
11 Write short notes on the following models of digital manufacturing system: i) Organization Model ii) Function model iii) Information model iv) Operation & Control Model
12 Explain the role of Bionic Mechanics and Manufacturing Intelligence in Digital Manufacturing.

SUB CODE	EE 311	SUBJECT NAME	ELECTRICAL DRIVES & CONTROL FOR AUTOMATION

MODULE 1

1. Derive an expression for the e.m.f generated in a d.c machine
2. What is meant by armature reaction? How does it will affect the main field flux?
3. List out the different methods of excitation. Explain
4. 1. A d.c shunt generator operating at 850rpm is given below

   Eg(V): 12 40 102 176 210 240 256

   I_f (A) : 0 0.5 1 2 3 4 5

   The machine has 6 poles. The type of winding is lap. The number of conductors in the armature is 540.

   i) Calculate the residual flux per pole

   ii) The no load emf for a total shunt field resistance of 120Ω

   iii) The critical field resistance of field circuit

   iv) The critical speed for the shunt field resistance of 120 Ω
5. Define critical speed and critical field resistance of a dc shunt generator.
6. An 8-pole wave connected DC generator has 1000 armature conductors and flux per pole is 0.035Wb. At what speed must it be driven to generate 500V?
7. Draw the open circuit characteristics of a DC shunt generator and define critical resistance.
8. A DC shunt generator having a terminal voltage of 250V delivers a load current of 195A. The armature and shunt field resistances are 0.05 ohm and 50 ohms respectively. Calculate:

   i) Armature current

   ii) Generated emf in armature.
9. With the help of a neat circuit diagram explain the procedure for obtaining the internal and external characteristics of a DC shunt generator
10. Write any two methods for compensating the effects of armature reaction in DC generators

MODULE 2

1. Derive an expression for the electromangentic torque developed in dc motor
2. A dc shunt motor runs at 1300rpm on no load drawing 5A from 200V mains. Armature and field resistance are 0.24 Ω and 110 Ω respectively. When loaded, the motor draws 60A from the mains. Calculate the speed when the motor is loaded. Assume that the armature reaction demagnetizes the field by 3%. Also calculate the internal torque developed at no load and on load. What is the motor shaft at load ?
3. Derive the speed-torque characteristics of a d.c shunt and d.c series motor
4. What are the losses occurring in a d.c motor and how do they vary with load current?
5. Why a starter is required for starting a d.c motor?
6. Explain how the torque is developed in a DC motor?
7. What is meant by back emf in DC motors? A 230 V DC shunt motor takes 32 Amp at full load. Find the back emf on full load if resistances of motor armature and shunt field windings are 0.2 ohm and 115 ohms respectively.
8. Give the classification of DC motors with applications
9. Draw the power conversion stages of a DC motor
10. With a neat figure explain the method for conducting load test in a DC shunt motor.

MODULE 3

1. Derive the e.m.f equation of a single phase transformer
2. Draw the phasor diagram of a 1-phase transformer at no load and derive the equivalent circuit
3. Explain the difference between an ideal transformer and an actual transformer
4. What are the losses produced in a transformer and derive the condition for maximum efficiency
5. A 40kVA single phase transformer has iron loss of 450W and full load copper loss of 850W. If the pf

of the load is 0.8 calculate:

i) The full load efficiency.

ii) The maximum efficiency.

iii) The load at which maximum efficiency occur.

6 Write short notes on instrument transformers

7 A 40 KVA single phase transformer has 400 turns on the primary and 100 turns on the secondary. The primary is connected to 2000 V, 50 hz supply. Determine:

i) The Secondary voltage on open circuit

ii) Maximum value of flux

8 Draw the phasor diagram of a single-phase transformer with inductive load and mark each phasor clearly

9 What is an auto transformer? With suitable derivations, prove that there is saving of copper in auto transformer compared to ordinary transformer

10 Obtain the approximate equivalent circuit With respect to low voltage side of a given 200/2000 V single phase 30 KVA transformer having the following test results.

O.C test:- 200V, 6.2A, 360W on L.V. side

S.C test:- 75 V, 18A, 600W on H.V side

11 Define the all-day efficiency of a distribution transformer. What is its significance?

MODULE 4

1 Explain the principle of operation of a 3-phase induction motor

2 Differentiate between squirrel cage and slipring induction motor

3 Write short note on torque-slip characteristics of a 3-phase induction motor

4 Explain no load and blocked rotor test on a 3-phase induction motor and derive the equivalent circuit parameters

5 What is meant by circle diagram of a induction motor? What are the information that can be obtained from the circle diagram?

6 Explain with the help of neat diagram the working of any two methods of starting a 3-phase induction motor

7 With neat sketch, explain the development of rotating magnetic field in a three phase induction motor

8 A three phase induction motor has 2 poles and is connected to 400 V, 50 hz supply. Calculate the actual rotor speed and rotor frequency when slip is 4%.

9 Draw the equivalent circuit per phase of a three-phase induction motor and explain

10 A 40 KW 6 pole three phase induction motor delivers full load output at 950 rpm at 0.85p.f when connected to a 500 volt, 50 hz supply. Friction and windage losses equals 1.5KW and stator losses are 1.8KW. Determine for this load:

i) Total copper loss

ii) Efficiency

MODULE 5

1 Derive the emf equation of an alternator.

2 What is meant by regulation of an alternator

3 How can you determine the regulation of an alternator by emf method? Explain

4 Explain the principle of operation of single phase induction motor

5 Explain the pitch factor and distribution factor of an alternator

6 What is a universal motor? What are the applications of this type of motors?

7 Why synchronous motor has no net starting torque?

8 Explain the methods of starting of synchronous motor

SUB CODE	EE 311	SUBJECT NAME	ELECTRICAL DRIVES & CONTROL FOR AUTOMATION

9 What is synchronous condenser?
10 With suitable graphs explain the method to determine voltage regulation of an alternator by EMF method.
11 Draw and explain the 'V' curves of a synchronous motor.
12 A three-phase star connected alternator is rated at 1600 KVA, 13500 Volt. The armature resistance and synchronous reactance are 1.5 and 30 ohms respectively per phase. Calculate the percentage voltage regulation for a load of 1820 KW at 0.8 leading p.f.

MODULE 6

1 Draw and explain the torque-speed characteristics of stepper motor.
2 Write short notes on servo control and digital controllers
3 What is machine tool controller ?
4 With neat diagram explain programmable logic controllers.
5 With a neat sketch, explain the working of a permanent magnet stepper motor
6 List out the classification of stepper motor and compare them
7 Draw the schematic diagram of a variable reluctance motor and explain its working.
8 What is micro stepping? Determine the step angle of a variable reluctance stepper motor with 12 teeth in stator and 8 rotor teeth
9 With suitable block diagrams explain the control of stepper motors.
10 Give the two major classification of general control systems and explain them with suitable block diagrams. Give examples for each type.
11 Write a note on different types of controllers for automation

ME305 COMPUTER PROGRAMMING AND NUMERICAL METHODS

MODULE 1

1. Define an algorithm. Explain the properties of an algorithm (5)
2. Explain different flow chart symbols (5)
3. Differentiate procedure oriented programming and object oriented programming (5)
4. Explain basic concepts of object oriented programming (10)
5. Give the structure of a C++ program (2)
6. Discuss tokens of C++ program (10)
7. List out the rules for naming an identifier (2)
8. Differentiate keywords and identifiers (2)
9. Explain various operators in C++ (5)
10. Give the syntax of the conditional operator (2)
11. Write a program to find smallest of 2 numbers using conditional operator (5)

MODULE 2

1. Explain different conditional statements in C++ with flowcharts (10)
2. Differentiate **break** and **continue** **(5)**
3. Write a program to check whether a number is odd or even (3)
4. Write a program to check whether a triangle is valid or not(angles) (3)
5. Write a program to find largest of 3 numbers. Also draw the flowchart (5)
6. Explain the use of **switch case** using an example (3)
7. Write a program to implement desktop calculator (5)
8. Give the syntax and flowchart of different looping statements (5)
9. Write a program to find sum and product of n natural numbers (5)
10. Write a program to find sum and product of any n numbers (5)
11. Write a program to find any power of a number (5)
12. Differentiate entry controlled loops and exit controlled loops (5)
13. Write a program to find the sum of digits of a number (5)
14. Write a program to check whether a number is Armstrong or not (5)
15. Define and explain an array (5)
16. Explain different method to declare and initialize arrays (5)
17. Explain different method to declare and initialize 2D arrays (5)
18. Write a program to find largest element in an array (5)
19. Write a program to find count/frequency of an element in an array (5)
20. Define a function. Describe different components of a function (8)
21. Differentiate function definition and function declaration (4)
22. Explain function prototyping using an example (2)
23. Explain different categories of function (8)
24. What is an inline function? (2)
25. Explain function overloading with examples (5)

26. Write a program to find sum and product of n numbers using functions **sum( )** and **product( )** **(10)**
27. Write a program to find largest of n numbers using a function **big( )** (10)
28. Define recursion with an example (5)
29. Write a program to find ${}^{n}C_{r}$ using function **fact( )** (5)

MODULE 3

1. Discuss pointers and their uses (5)
2. Explain different types of parameter passing (10)
3. Explain function call by reference method with an example (5)
4. Write a program to find factorial of a number using following methods (10)
    a. Iteration
    b. Recursion
5. Write a program to print Fibonacci series using following methods (10)
    a. Iteration
    b. recursion
6. Write a program to find sum of following infinite series (10)
    a. 1+2+3+…+n
    b. 1/1 +1/2 +1/3 …+1/n
    c. 1/1! +1/2! +1/3! …+1/n!
    d. 1/2+2/3+ 3/4+ …n/n+1
7. Write any two algorithms for sorting (10)
8. Write a program to sort following numbers in ascending order 12,34,2,67,4,90,54,1 (5)
9. Write a program to add 2 matrices (5)
10. Write a program to multiply two 5x5 matrices (8)
11. Write a program to find transpose of a matrix (5)
12. Write a program to convert all negative numbers of a matrix to zero (10)
13. Write program to implement linear search (5)
14. Write a program to implement binary search` (10)

MODULE 4

1. Differentiate class and object (5)
2. How to define a class and declare an object? (5)
3. Explain the different ways to define member functions (4)
4. Explain different access specifiers (5)
5. What is Friend function (4)
6. Explain how to access data members and member function (5)
7. What base class and derived class (3)
8. Explain different types of inheritance (10)
9. What are different types of constructors (5)

10. Differentiate constructors and destructors (5)

MODULE 5

1. Discuss different sources of errors (5)
2. Explain the method of Gauss elimination (5)
3. Write the program to implement Gauss elimination (5)
4. Solve the system of linear equations using Gauss Jordan Method (10)
   $X_1 + 2X_2 + 3X3 + 4X4 = 10$
   $7X_1 + 10X_2 + 5X3 + 2X4 = 40$
   $13X_1 + 6X_2 + 2X3 - 3X4 = 34$
   $11X_1 + 14X_2 + 8X3 - X4 = 64$

5. Solve the system of linear equations using Gauss Seidel Method (10)
   $X_1 + 2X_2 + 3X3 + 4X4 = 10$
   $7X_1 + 10X_2 + 5X3 + 2X4 = 40$
   $13X_1 + 6X_2 + 2X3 - 3X4 = 34$
   $11X_1 + 14X_2 + 8X3 - X4 = 64$

6. Find the interpolation polynomial for the given values (10)

x	1	2	3	4	5
y	1	1.4142	1.7321	2	2.2361

7. Using above data find the function value at x= 2.5 (10)
8. Explain Lagrange interpolation with suitable example. Also write the program for finding function value using Lagrange method (10)

MODULE 6

1. Explain how to classify partial differential equations (5)
2. Find the behavior of given partial differential equation (2)
   $x^2 f_{xx} + (1-y^2) f_{yy} = 0$
3. Fit a parabola of the form y=a+bx+cx to the following data (10)

X	0	1	3	6	8
Y	1	3	2	5	4

4. Fit a straight line of the form y=a+bx to the following data by the method of least squares (10)

X	0	1	3	6	8
Y	1	3	2	5	4

5. Prepare a C++ program for fitting a straight line to a given set of data (10)

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6. Write down the standard five-point formula and standard five-point diagonal formula(5)
7. Explain about correlation (5)
8. Approximate the solution of the equation $f_{xx} = f_t$, satisfying the conditions **f(x,0) =sin(πx)** and **f(0,t)=f(1,t)=0 $0 \leq t \leq 0.025$** choosing $\Delta x=0.1$and an appropriate Δt and tabulate the value of $\mathbf{f_{i,j}}$ for **$0 \leq i \leq 10$** and **$0 \leq j \leq 5$** **(5)**

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MODULE 1

1. List most commonly used NDT methods. State advantages and limitations of NDT (GTU May 2012)

2. Discuss briefly about selection of different NDT techniques for detection of defects. (GTU May 2012)

3. Discuss most commonly used Non Destructive methods. What are the Selection criteria for any NDT Method? (GTU May 2012)

4. Explain destructive & non-destructive testing. What are the applications, advantages & disadvantages of Non-destructive testing with compare to destructive testing?

5. What is Visual examination? Explain Visual examination method using Boroscope.

6. Define the visual testing technique. What are the various Instruments used to enhance the testing.

7. Write note on Visual examination and list different Visual examination methods explain any one.

8. What is meant by visual inspection of materials/ component? Explain the role of visual inspection in non-destructive testing giving suitable examples.

9. Give the names of a few visual aids and their uses in NDT

10. Explain what is Holographic testing? What are its applications & limitations?

11. What are the different optical aids used for Visual Inspection?

12. Explain about

    1) Microscope

    2) Borescope

    3) Endoscope

    4) Flexiscope

    5) Telescope

    6) Holography

13. What are the different NDT methods? State its advantages and limitations.

14. What are different material testing? Differentiate between them.

15. Discuss briefly about selection of different NDT techniques for detection of defects.

16. Discuss briefly about selection procedure of different NDT techniques for detection of defects.

MODULE 2

1. What is dye penetrant test? Explain cleaners, penetrants and developers. (GTU May 2012)

2. Discuss the steps for dye penetrant test with neat sketch. (GTU May 2012)

3. Explain the method of Die Penetrant Testing (DPT) with diagram. Can it be used for subsurface defects? Yes/ no—Justify. (GTU May 2012)

4. What are the different types of Penetrants used? (GTU May 2012)

5. Discuss liquid penetrant Testing with reference to i) Steps of operation ii) Principle iii) Different types of penetrant iv) Limitations.

6. Briefly Explain Method of Dye Penetrant Testing. Which method is best for in-situ inspection of a Pipe line of a refinery? Why?

7. Define Piezoelectric Materials & penetrant testing Materials.

8. With necessary sketch discuss dye penetrant testing in detail.

MODULE 3

1. What is Magnetic particle testing? List its limitations. (GTU May 2012)

2. Explain procedure of Magnetic particle testing. (GTU May 2012)

3. What is the basic principle of Magnetic Particle Testing (GTU May 2012)

4. What are the types of magnetic Fields? Draw line diagram & explain its importance?

5. Define the magnetic particle testing. What are the various methods used to magnetize the specimen, with neat diagram.

6. Define Magnetic flux & draw diagram of different types of magnetic fields used in MPT.

7. Discuss magnetic particle testing principle, advantages and limitations.

8. Discuss Magnetic Particle Testing with reference to

    i) Steps of Operation

    ii) Principle

    iii) Method of Magnetization

    iv) Limitations

MODULE 4

1. Explain the principle of ultrasonic testing. Give its applications, advantages and limitations. (GTU May 2012)

2. What is A Scan, B Scan- C Scan presentation in ultrasonic testing? Explain each with specific application. (GTU May 2012)

3. Discuss about ultrasonic transducers (probes). (GTU May 2012)

4. List applications, advantages and limitations of ultrasonic testing.

5. What is the principle of ultrasonic testing? Discuss different methods of ultrasonic testing.

6. Write the principle of Ultra Sonic Testing (UT). What are the types of transducers are used in UT.? Explain with suitable diagram.

7. Explain the Characterization procedure for analysing defects in Welded Product using UT.

8. What is couplant in ultrasonic testing, gives its role? Give advantages and limitations of ultrasonic testing.

9. Explain different transducers in ultrasonic testing with neat sketch.

10. Discuss in brief the pulse echo ultrasonic testing technique and its application.

11. Explain different transducers in ultrasonic testing with neat sketch.

12. What is couplant in ultrasonic testing? What is its role? State its advantages and disadvantages.

13. What is an immersion testing technique in Ultrasonic testing? Explain with advantages and disadvantages.

14. Explain briefly various ultrasonic inspection techniques.

15. With line diagram explain ultrasonic flaw detection equipment.

16. Explain the basic wave propagation principle of Ultrasonic testing.

17. Discuss the normal beam inspection technique.

MODULE 5

1. Discuss radiography in welding briefly (GTU May 2012)

2. Differentiate between X-ray radiography & Gamma Radiography Testing. (GTU May 2012)

3. Explain the principle of Radiographic testing with neat diagram. Describe its Demerits. (GTU May 2012)

4. Explain the method for generating Gamma-ray.

5. Differentiate between X-ray & gamma-ray radiographic testing.

6. What are filters and screens used in X- ray radiography? Why are they used?

7. Write a brief note on Radiographic film and its processing.

8. Explain the Interpretation of Radiograph and State safety precaution in Industrial radiography.

9. Explain the principle of Radiographic testing? Write briefly the method of generation of X-rays.

10. Explain basic principle of Radiographic examination.

11. Discuss principle of radiographic testing and give its application and limitation

12. Explain the principle, application and disadvantages of Radiographic Testing.

13. Name various defects found in casting & forgings. How will you identify them?

14. Explain principle of Radiographic Testing and give its application and limitations.

15. Explain principle of radiographic testing and give its applications and limitations.

MODULE 6

1. What is the principle of eddy current testing (ECT)? What is sensitivity in ECT?

2. Explain principles of Eddy Current Testing (ECT). What do you understand by sensitivity in ECT? Narrate one application on ECT.

3. What is the principle of Eddy current testing? What are its applications? Explain its merits & demerits.

4. Discuss eddy current testing principle, advantages and limitations.

5. Write a short note on Eddy current testing.

6. Discuss about techniques of ECT.

7. Discuss most commonly used Non Destructive methods. What are the Selection criteria for any NDT Method?

SUB CODE	ME 401	SUBJECT NAME	Advanced metal casting

MODULE 1

1	State the properties of molding sand.	4
2	Explain different types of gating system with the help of figures.	10
3	What is the use function of chills?	4
4	What is meant by aspiration? How it can be prevented?	4
5	What are the advantages and disadvantages of green sand molds?	4
6	Describe, briefly the test done on molding sands.	4
7	Give an account of different types of molds.	10
8	Describe, in detail, the procedure for making a green sand mold.	10
9	Explain the various ingredients of molding sand and describe the effects of each ingredient on the properties of molding sand.	10
10	What is meant by skin dried mold? Give its application.	4

MODULE 2

1	What should be the shape and size of a riser for obtaining a sound casting?	4
2	What is the function of external and internal chills?	4
3	The down spruce leading into the runner of a certain mold has a length = 175 mm. The cross sectional area at the base of the spruce is 400 mm^2. The mold cavity has a volume = .001 m^3. Determine (a) the velocity of the molten metal flowing through the base of the down spruce, (b) the volume flow rate, and (c) the time required to fill the mold cavity.	10
4	A steel plate 40 cm x 30 cm x 0.3 cm is to be cast. The volume shrinkage of steel during solidification is 3%. A cylindrical side riser with diameter 4 cm and height 4 cm is used. The riser volume should be at least 3 times that the dictated by shrinkage considerations. Is the riser volume sufficient, if not what is the riser size?	10
5	Calculate the size of a cylindrical riser, whose height and diameter are equal, to feed a steel slab casting 30 mm x 30 cm x 6 cm with a side riser. Casting poured horizontally into the mold.	
6	During filling of a cylindrical casting cavity of 200 mm diameter and 300 mm length using a gating system having gating ratio 1:1.5:2 and height of the molten metal above the in-gate is 250 mm, the time taken for filling the cavity is 25 second. Determine the diameter of the spruce to avoid aspiration effect?	10
7	In a sand casting of hollow part of lead, a cylindrical core of diameter 120 mm and height 180 mm is placed inside the mold cavity. The densities of core material and lead are 1600 kg/m^3 and 11300 kg/m^3 respectively. Find the net force (in N) that tends to lift the core during pouring molten metal.	10
8	Explain different types of gating system with the help of diagrams.	10
9	In a non pressurized gating system, an aluminium alloy is poured at a flow rate of 1.6 $x10^{-3}$ m^3/sec through a spruce with a base cross sectional area of 800 mm^2. If the friction losses in the spruce are neglected, find the height of the spruce.	10
10	What is the function of riser? Briefly write notes on different types of risers.	4

SUB CODE	ME 401	SUBJECT NAME	Advanced metal casting

MODULE 3

1	Explain the solidification process in casting. How does solidification of alloys differ from solidification of pure metals?	4
2	What do you mean by fluidity? Explain any method used for measuring fluidity.	4
3	Explain the factors affecting fluidity.	10
4	A casting of 200x100x50 mm size solidifies in ten minutes, Estimate the solidification time for a 200x 100x 10 mm casting under similar conditions.	10
5	In the casting of steel under certain mold conditions, the mold constant in Chvorinov's Rule is known to be 4.0 min/cm ^{2}, based on previous experience. The casting is a flat plate whose length l= 30 cm, width w= 10 cm, and thickness h= 20 mm. Determine how long it will take for the casting to solidify.	10
6	Explain grain growth and solidification during solidification.	10
7	Explain degassing in casting.	4
8	A cylinder of 150 mm diameter and 200 mm height is to be cast without any riser. The cylinder is molded entirely in the drag of a green sand flask and is top gated .The cope of the flask is 200 mm in height and the height of the metal during pouring is 50 mm above the cop. A tapered spruce is employed and the gating ratio is 1:1.5:2. The time taken to fill the casting cavity neglecting energy losses, if the in-gate area is 400 mm^2. . .	10
9	Write the effects of mold material and alloy composition on casting.	10
10	Briefly explain segregation during solidification.	10

MODULE 4

1	Explain the resistances to heat flow from the interior of the casting.	10
2	Explain any two crystal growth methods with the help of diagram.	10
3	Explain different methods used for manipulating heat transfer during solidification.	10
4	Explain any one method for the study of heat transfer during solidification.	10
5	What are the precautions taken to prevent freezing at mold wall?	4
6	Explain the effect of mold surface on heat transfer during solidification.	4
7	What is dendric growth? Explain with diagram.	4
8	Explain methods to aid heat transfer in casting.	4

MODULE 5

1	State the advantages and limitation of aluminium alloy castings.	4
2	Mention different alloys of iron and its uses.	10
3	Mention different alloys of aluminium and its uses.	10
4	Mention different alloys of magnesium and its uses.	10
5	Mention different alloys of copper and its uses.	10
6	Explain the functions of coke and limestone in steel production process.	4
7	Explain any one steel making process.	10
8	What is function of flux in casting?	4
9	Write short note on Aluminium production.	4
10	What is pig iron?	4

SUB CODE	ME 401	SUBJECT NAME	Advanced metal casting

MODULE 6

1 What is dross or slag? How it can be prevented from becoming a part of the finished casting? . 4

2 Explain defects in final casting and the remedies for it. 10

3 Explain the methods used for testing castings. 10

4 Briefly explain . 10
   a) dye penetrant testing
   b) Ultrasonic testing.

5 Explain : . 10
   a) Blow hole
   b) Blister
   c) Misrun
   d) Rat tail

6 Discuss the economic consideration in foundry practice. 10

7 Briefly explain:
   a) Magnetic flaw detection
   b) Radiography

8 Explain the design consideration for casting. 10

9 Explain: 10
   a) Sand inclusion
   b) Dross
   c) Porosity
   d) Cold shut

10 Write short notes on scab and swell. 10