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T.E. (Mechanical) (Part - III) (Semester - VI)**Examination, November - 2019****INDUSTRIAL FLUID POWER****Sub. Code : 66838****Day and Date : Thursday, 14 - 11 - 2019****Total Marks : 100****Time : 10.00 a.m. to 1.00 p.m.**

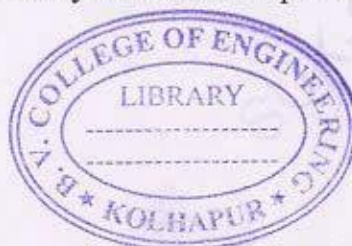
- Instructions :**
- 1) Attempt all questions.
 - 2) Draw neat sketches wherever necessary.
 - 3) Assume suitable data wherever necessary and mention it correctly.

Q1) Attempt any two of the following.

- a) Draw a neat sketch of basic pneumatic system using ISO symbols and write various applications. [9]
- b) Write different types of hydraulic fluids and their properties and selection. [9]
- c) Draw proportionate ISO symbol for the following elements. [9]
 - i) Weight loaded accumulator
 - ii) Pilot operated check valve
 - iii) FRL Unit
 - iv) Directly operated pressure reducing valve
 - v) 4/3 detent control valve
 - vi) Single acting telescopic cylinder.

Q2) Attempt any two of the following.

- a) Write a note on fluid conductor, filter and heat exchanger. [9]
- b) Draw neat sketch of balanced type of vane pump and write its working. [9]
- c) What do you mean by linear and rotary actuator? Explain construction and symbol of tandem cylinder. [9]

**P.T.O.**

- Q3) a) Explain various center positions, NO and NC design of a DCV [8]
b) Explain with neat sketch and symbol pressure relief and pressure reducing valve. [8]
- Q4) a) Explain with neat sketch symbol and working of 4/2 seat type direction control valve for pneumatic system. [8]
b) Explain speed regulations of pneumatic system using exhaust air throttling. [8]
- Q5) a) What is regenerative circuit? Explain with neat sketch. [8]
b) Explain use of twin pressure valve AND for control of motion of single acting pneumatic cylinder with proper BIS symbols and state its importance. [8]
- Q6) a) What are different fluid amplifiers? Explain bi-stable (flip flop) amplifier with neat sketch. [8]
b) What are general guidelines for maintenance and troubleshooting of hydraulic and pneumatic system. [8]



SC-79

Total No. of Pages : 3

Seat No.	
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T.E. (Mechanical Engineering) (Part - III) (Semester - V)
Examination, November - 2019
THEORY OF MACHINES - II
Sub. Code : 66242

Day and Date : Monday, 25 - 11 - 2019
Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

- Instructions :
- 1) All questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - 3) Make suitable assumptions wherever required and state them clearly.
 - 4) Use of non-programmable calculator is permitted.
 - 5) Draw neat diagrams wherever necessary.

- Q1) a) Derive the expression for the minimum number of teeth required on pinion to avoid interference in mesh with gear.

OR

Prove that velocity of sliding is proportional to the distance of the point contact from the pitch point. [8]

- b) A 20° involute gear of 8 mm module with 50 teeth is driven by a pinion of 20 teeth. If the contact ratio is to be maximum without interference, find the addendum of pinion, gear, length of path of contact and contact ratio. [10]

- Q2) a) An epicyclic gear train consists of sun, planet, arm and annular gear. Derive the equation of velocity ratio.

OR

A geared system consists of three gears A, B, C with T_A , T_B , and T_C teeth forming a simple gear train. Derive the equation of inertia torque applied at driving gear. [6]



P.T.O.

SC-79

- b) An epicyclic gear train is shown in fig 2b. The arm 'a' rotates at 200 r.p.m. The gear 'P' with 20 teeth and gear 'B' with 40 teeth are compounded and rotate freely on the pin carried on the arm. The gear 'I' (30 teeth) is attached to the shaft. Find the speed of the shaft carrying gear 'I' and its relative direction to the arm. [10]

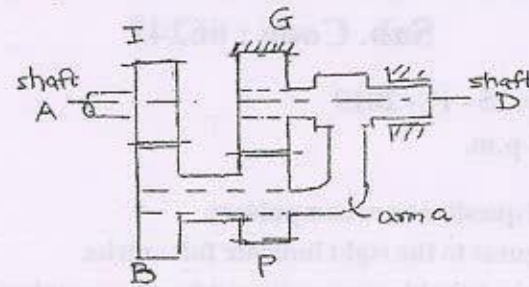


Fig 2b

- Q3) a) Explain with sketch the following as related to gyroscope. [6]
- Axis of Spin
 - Axis of Precession,
 - Active couple and
 - Reactive couple
- b) The turbine rotor of a ship has mass moment of inertia of 324 kg-m^2 . It rotates at 1800 rpm when looking from stern. [10]
- Determine the gyroscopic couple and its direction when the ship is traveling at 40 km/hr and steers to the left in a curve of 100 m radius.
 - If a maximum gyroscopic couple of 8000 Nm is permitted, what is the limiting speed of the rotor? Assume the speed of ship is proportional to rotor speed.

- Q4) a) With neat sketch, explain various dynamic forces acting in reciprocating engine mechanism. [6]

OR

Explain Trifilar suspension system for determining M.I. of rigid body. [6]

SC-79

- b) The following data relate to a horizontal reciprocating engine:
 Mass of reciprocating parts = 120 kg, Crank Length = 90 mm, Engine speed = 600, Mass of connecting rod = 90 kg, Length between centers of connecting rod = 450 mm, Distance of center of mass from big end center = 180 mm, Radius of gyration about axis through center of mass = 150 mm.

Find the magnitude and direction of the inertia torque on the crank shaft when the crank has turned through 30° from the inner dead center. [10]

- Q5) a) Explain partial balancing of reciprocating masses in slider crank mechanism. [6]

OR

Explain primary crank and secondary crank in balancing of inline cylinder engine. [6]

- b) The cranks and connecting rods of a 4-cylinder in-line engine running at 1800 rpm are 60 mm and 240 mm each respectively and the cylinders are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 15 kg. Determine. [12]
- Unbalanced primary and secondary forces if any.
 - Unbalanced primary and secondary couples if any.

- Q6) a) Explain Turning Moment Diagram used in analysis of flywheel. Also draw Turning Moment Diagram for steam engine, 4-stroke engine and multi cylinder engine. [6]
- b) The radius of gyration of a flywheel is 1 meter and the fluctuation of speed is not to exceed 1% of the mean speed of the flywheel. If the mass of flywheel is 3340 kg and the steam engine develops 150 Kw at 135 rpm, then find; [10]
- Maximum fluctuation of energy
 - Co-efficient of fluctuation of energy.



- a) A pair of parallel helical gears consists of 18 teeth pinion rotating at 6000 rpm and supplying 2.5 KW power to the gear. The normal pressure angle is 20° and the helix angle is 23° . The reduction ratio is 4:1. The pinions and the gear is made of steel 40C8 ($S_{ut}=600\text{N/mm}^2$). The service factor and factor of safety are 1.5 and 1.8 respectively. The gears are machined to meet the specification of grade 6. Assume that the pitch velocity is 10 m/s, estimate the normal module and major dimension of gears. Determine the dynamic load using M.F Spotts equation and specify surface hardness.

Use Y for 23 teeth=0.333 and Y for 25 teeth=0.34.

For grade 6, $e=8+0.63(m+0.25\sqrt{d})$ in μm .

[10]

OR

A pair of straight tooth bevel gears has a velocity ratio 2:1. The pitch circle diameter of the pinion is 80 mm at large end of the tooth. 5 KW power is supplied to the pinion, which rotates at 800 rpm. The face width is 40 mm and the pressure angle is 20° . Determine the tangential, radial and axial components of resultant tooth force acting on the pinion.

[10]

- b) Explain with neat sketch the concept of virtual number of teeth and its significant in the design of helical gear. [6]

- 6) a) Derive an expression for the Beam strength of the bevel gear. [6]

OR

- a) Discuss the thermal consideration in the design of worm and worm wheel drive. [6]

- b) A pair of worm gears is designated as 2/54/10/5. Determine: [10]

- The center distance
- The speed reduction
- The dimensions of the worm
- The dimensions of the worm wheel.



Seat No.	
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T.E. (Mechanical) (Semester - VI) (Revised)

Examination, November - 2019

MACHINE DESIGN-II

Sub. Code : 66840

Day and Date : Tuesday, 19- 11 - 2019

Total Marks : 100

Time : 10.00 a.m to 1.00 p.m.

- Instructions :
- Figures to right indicate full marks to the question.
 - Use of programmable calculator is allowed.
 - Assume any data if necessary and state it clearly.

- 1) a) Define the notch sensitivity and explain its significance in design. [6]

OR

Explain the following terms in connection with design of machine members subjected to various loads. [6]

- Endurance Limit
- Surface finish factor
- Size factor

- b) The work cycle of a mechanical component is subjected to a completely reversed bending stresses consisting of the following three elements:

- $\pm 600\text{N/mm}^2$ for 5% of time
- $\pm 550\text{N/mm}^2$ for 10% of time
- $\pm 400\text{N/mm}^2$ for 85% of time

Material for the component is 50C4 ($S_{ut}=660\text{N/mm}^2$) & the corrected endurance strength is 280N/mm^2 . Determine the life of component. [10]



P.T.O.

- 2) a) Explain with neat sketches various design consideration of casting [6]

OR

Derive Stribeck's equation for rolling contact bearing along with assumption made. [6]

- b) Select the ball bearing for a shaft of an electric motor having step diameter 50 mm rotating at 1440 rpm. Assume that load is purely radial of 5000 N and desired life of 11000 hours. The service factor may be taken as 1.0. [10]

Use following reference table for selecting bearing.

Bearing No.	6010	6210	6310	6410
Static Load rating (kN)	21.20	42.50	35.00	46.50
Dynamic Load rating(kN)	27.50	52.00	48.00	58.50

- 3) a) Explain the desirable properties of good bearing material. [6]

OR

Explain the following terms in relation to sliding contact bearing. [6]

- Length to diameter ratio
- Unit Bearing Pressure
- Radial Clearance

- b) A following data is given to 360° hydrodynamic bearing. [12]

Journal Diameter=50 mm, Bearing length=50 mm,

Radial Load=3.2kN, Journal speed=1490 rpm,

Radial Clearance=0.05 mm, Viscosity of Lubricant=25 Cp.

Determine:

- The coefficient of friction
- Power lost in friction
- Minimum oil film thickness
- Flow requirement in lit/min.
- Temperature rise

Refer following table:

l/d	ϵ	h_o/C	S	θ	$(r/C)f$	$Q/(rCn_s l)$	Q_s/Q
1	0.4	0.6	0.264	63.10	5.79	3.99	0.497
	0.6	0.4	0.121	50.38	3.22	4.33	0.680
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842
	0.9	0.1	0.0118	26.45	1.05	4.74	0.919
	0.97	0.03	0.00474	15.47	0.514	4.82	0.913

- 4) a) State the various materials used for gear manufacturing. Specify their field of application. [8]

OR

Explain the term static and dynamic loads on gear tooth. Describe various parameters which contribute dynamic load. [8]

- b) A pair of spur gear with 20° full depth involute consists of 18 teeth pinion meshing with 40 teeth gear. The module is 4 mm and the face width is 40 mm. The pinion is made of alloy steel while gear is made of plain carbon steel for which the permissible bending stresses are 250 N/mm² and 200N/mm² respectively. The gears are machined to meet the specification of grade of 8 and heat treated to surface hardness of 400 BHN. If the pinion rotates at 1440 rpm. Use Lewis form factor Y for 18 teeth is 0.308 and for 40 teeth is 0.389. [10]

Determine

- The beam strength
- The wear strength
- The Dynamic load by Spott's Equation For grade 8, error $e=16+1.25(m+.25\sqrt{d})$ in μ m, $d=p.c.d.$

SC - 60

Total No. of Pages : 3

Seat No.	
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T.E. (Mechanical) (Part - III) (Semester - VI) (Revised)
Examination, November - 2019
METROLOGY AND QUALITY CONTROL
Sub. Code : 66839

Day and Date : Friday, 15 - 11 - 2019

Total Marks : 100

Time : 10.00 a.m. to 1.00 p.m.

- Instructions :
- 1) All questions are compulsory.
 - 2) Figures to right indicate full marks.
 - 3) Draw neat labeled sketch wherever necessary.
 - 4) Assume any data if necessary and state it clearly.

Q1) Attempt any two questions of the following [18]

- a) Describe the following types of errors & how they can be taken care of
 - i) Environmental Error
 - ii) Parallax error
- b) Explain with the help of sketches the method of wringing of slip gauges. Build up gauge blocks to produce a dimension of 43.716 using a pair of 2.5 mm protractor blocks and M45 set.
- c) Explain the tolerance with suitable example. Also explain unilateral and bilateral tolerance.

Q2) Attempt any two questions of the following [16]

- a) Sketch & explain two forms of sine bar in general use. List the possible sources of error in a sine bar.
- b) Explain with neat sketch
 - i) Spirit level
 - ii) Clinometer
- c) Discuss working principle, advantage and limitations of Sigma comparator with neat sketch.



P.T.O.

Q3) Attempt any two questions of the following

[16]

- Explain with suitable example ten point height method and center line average method.
- Explain construction and working of Tomlinson surface meter.
- Explain with neat sketch the checking of flatness by interferometry.

Q4) Attempt any two questions of the following

[16]

- Explain with the neat sketch construction and working of gear tooth vernier caliper.
- Derive the expression for measurement of effective diameter of thread by using three wire method.
- Derive the expression for measurement of tooth thickness of the gear at the pitch line with gear tooth vernier caliper.

Q5) Attempt any two questions of the following

[16]

- Differentiate
 - Quality control and Quality assurance
 - Sampling inspection and 100% inspection.
- What is cost of quality? Explain cost of failure, cost of appraisal and cost of prevention.
- Explain with suitable example following quality control tools.
 - Histogram
 - Pareto Diagram

Q6) Attempt any two questions of the following

[18]

- Explain with suitable example producer and consumer risk. Discuss instances for which one type of risk might be more important than other.
- What is the importance of the OC curve in the selection of sampling plan? Describe the impact of the sample size and the acceptance number on the OC curve.
- The following are the \bar{X} and R values of 4 subgroups of 5 readings. The specification limits for the components are 10.7 ± 0.2 establish the control limits for \bar{X} and R chart. Values of the constant used are $A_2 = 0.58$, $D_4 = 2.11$ & $D_3 = 0.00$.

Sr. No.	1	2	3	4
\bar{X}	10.2	12.1	10.8	10.5
R	1.1	1.3	0.9	0.8

x x x

SC-54

[18]

Q3) Write short notes on any three (6 marks each).

- Market Segmentation
- Advertising
- Evaluation of Purchase Performance.
- Cost reduction

Q4) Attempt any three from the following (6 marks each)

[18]

- What are the situations where OR techniques are applicable?
- Use Graphical Method to solve the following LPP

$$\text{Maximize } Z = 80x_1 + 120x_2$$

Subjected to constraints, $x_1 + x_2 \leq 9$,

$$20x_1 + 50x_2 \leq 360$$

$$x_1 \geq 2$$

$$x_2 \geq 3$$

$$x_1, x_2 \geq 0$$

- A firm makes products of X & Y and has total production capacity of 9 tons per day. X & Y require same production capacity. The firm has permanent contract to supply at least 2 tons of X and at least 3 tons of Y to another company. Each ton of X requires 20 machine-hours of production time and each ton of Y require 50 machine-hours of production time. Maximum possible of machine-hours per day are 360. All the firm's output can be sold and profit made is Rs. 80 per ton of X and Rs. 120 per ton of Y. Formulate the LPP to determine the production schedule for maximum profit.
- What is the role of Surplus variable and Slack variable in the simplex method?

Q5) Attempt any two from the following (7 marks each).

[14]

- How will you handle the following situation in transportation problem
 - Unbalanced
 - Degeneracy
 - Loops in transportation problem.

SC-54

Total No. of Pages : 4

Seat No.	
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T.E. (Mechanical) (Part - III) (Semester - VI) (New)
(Revised) Examination, November - 2019
INDUSTRIAL MANAGEMENT AND OPERATIONS RESEARCH
Sub. Code : 66837

Day and Date : Wednesday, 13 - 11 - 2019

Total Marks : 100

Time : 10.00 a.m. to 1.00 p.m.

- Instructions :
- All questions are compulsory.
 - Figures to the right indicate full marks.
 - Assume suitable data, if necessary.

Q1) Attempt any four from the following (5 marks each).

[20]

- How far the components of scientific management as proposed by Taylor are relevant in Indian situation?
- Compare different theories of motivation. Suggest suitable theory for motivating supervisory staff in manufacturing organization.
- Discuss the advantages and limitations of external sources of recruitment.
- What are the barriers in downward communication? How can these be made effective?
- Suggest some guiding principles in designing an effective control system.

Q2) Attempt any two from the following (6 marks each).

[12]

- Explain in brief various sources to obtain financial assistance for a small-scale industry.
- Discuss about qualities need to be developed if you want to be a successful entrepreneur.
- What are the possible reasons for accidents in heat treatment shop? Which preventive measures do you suggest to prevent those accidents?

P.T.O.

What will be your decision under the following approach.

- Pessimistic criterion
 - Optimistic criterion
 - Regret criterion
 - Laplace criterion
 - Hurwicz criterion with $\alpha = 0.4$
- b) The following table gives the activity time of a certain project together with immediate predecessor requirements.

Activity	Immediate predecessor	Time in days
A	I	05
B	H,F	10
C	D	03
D	I	12
E	C,G	08
F	A,D	10
G	A,D	05
H	A	11
I	-	05

- Draw the network
 - Determine the expected project completed time
 - Find critical path?
- c) Find the sequence, for the following seven jobs, that will minimize the total elapsed time for the completion of all jobs. Each job is processed in the same order ABC Entries give the time in hours on the machines.

		Jobs						
		1	2	3	4	5	6	7
Time	A	12	6	5	3	5	7	6
On M/c	B	7	8	9	8	7	8	3
	C	3	4	11	5	2	8	4

What is the minimum elapsed time?



- b) A project consists of four major jobs for which the contractors have submitted tenders. The tender amount in lakhs of rupees are given in the matrix below. Find the assignment that minimizes the total cost of the project.

Contractor	Jobs			
	a	b	c	d
1	10	24	30	15
2	16	22	28	12
3	12	20	32	10
4	9	26	34	16

- c) Find an optimal solution to the following transportation problem

From	Transportation cost in Rs. Per unit					Supply
	To					
	A	B	C	D	E	
P	4	1	3	4	4	60
Q	2	3	2	2	3	35
R	3	3	2	4	4	40
Demand	22	45	20	18	30	

Q6) Attempt any two from the following (9 marks each).

[18]

- a) The following matrix gives the score for of batsman on last delivery for different strategies S_1, S_2, S_3 and S_4 against different conditions N_1, N_2, N_3 and N_4 .

	N_1	N_2	N_3	N_4
S_1	1	6	3	0
S_2	4	2	2	2
S_3	2	0	4	3

Seat No.	
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T.E. (Mech.) (Semester - V)
Examination, November - 2019
CONTROL ENGINEERING
Sub. Code : 66241

Day and Date : Friday, 22 - 11 - 2019

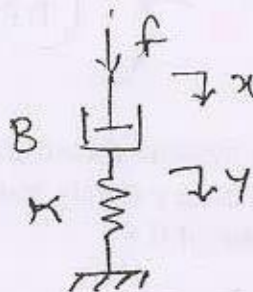
Total Marks : 100

Time : 2.30 p.m. to 5.30 p.m.

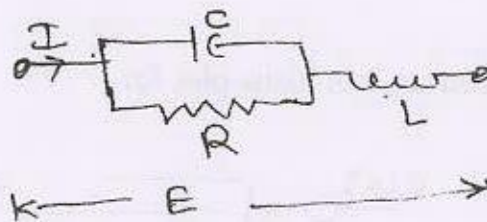
- Instructions : 1) All the questions are compulsory.
 2) Assume suitable data wherever required and mention it clearly.

Q1) a) For mechanical system shown in fig. below, determine the eqⁿ which relates [6]

- i) x to f ii) y to f iii) y to x



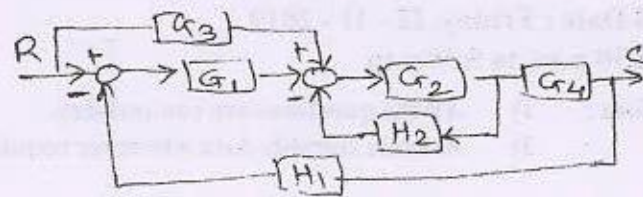
b) For the electrical system shown in fig. below, construct mechanical system which is in direct analog [6]



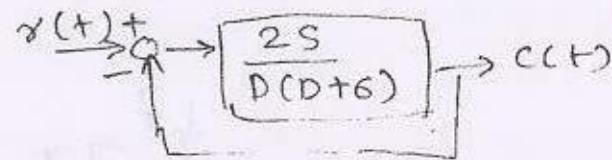
c) Write electrical analogy for fluid systems and explain in detail. [6]

P.T.O.

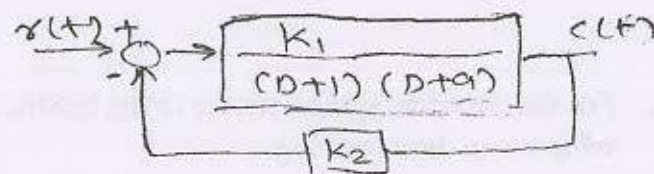
- 2) a) Effect a linear approximation for $T = 2\pi\sqrt{\frac{L}{G}}$. For $L_i = 100$ and $G_i = 32.2$, determine the change in the period due to an increase in L of 1 and decrease in G of 0.1 [8]
- b) Reduce the block diagram and find the transfer function. [8]



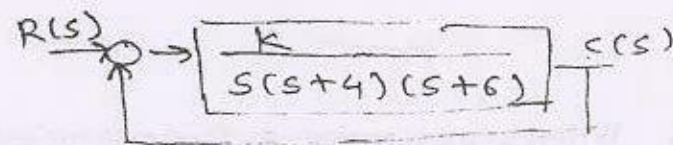
- 3) a) The forcing function is $r(t) = u(t)$ and all initial conditions are zero. Determine the response $c(t)$ of system [8]



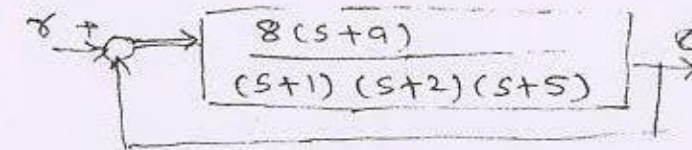
- b) For control system shown in fig. Determine K_1 , K_2 and 'a' such that system will have a steady state gain of 1, a natural frequency of '2' and damping ratio of 0.5. [8]



- 24) a) Construct root locus plot for [12]



- b) Determine value of 'a' such that system is stable [6]



- 25) a) Sketch the Bode plot for the transfer function

$$G(S) = \frac{1000}{S(1+0.1S)(1+0.001S)}$$

Determine gain margin and phase margin. [10]

- b) Find the break in point and angle of departure for the control system given by characteristic equation

$$1 + \frac{K(S+1)}{S^2 + 4S + 13} = 0$$

[6]

- 26) a) Determine state space representation & computer diagram using series method

$$y(t) = \frac{D+8}{D(D^2+8D+20)} f(t)$$

[8]

- b) Determine state space model and computer diagram using general method

$$y(t) = \frac{D+10}{(D^2+7D+10)} f(t)$$

[8]

■ ■ ■