Seat No. 22350

T.E. (Mech.) (Semester - VI) (New Course) Examination, May - 2015
COMPUTER INTEGRATED MANUFACTURING
Sub. Code : 45572

Day and Date : Friday, 15 - 05 - 2015

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

Total Marks : 100

Instructions :
1) Figures to the right indicate full marks to the question.
2) Answer three questions from each section.
3) Draw a neat - labeled block diagram whenever necessary.
4) Assume, if necessary, suitable data and state clearly.
5) Answers to the two sections must be written in one answer book indicating clearly question no. and section no.

SECTION - I

Q1) a) What are the benefits, limitations and obstacles in implementation of CIM? **[8]**

b) Explain the role of CAD/CAM in product design. **[8]**

Q2) a) Explain design and manufacturing attributes. What is production flow analysis. (PFA)? **[8]**

b) Define FMS and explain the various types of FMS. **[8]**

Q3) a) Explain in brief three phases of shop floor control with its block diagram. **[8]**

b) Draw structure of MRP- I and explain the inputs of MRP - I with product structure. **[8]**

Q4) Write short notes on (3) **[18]**

a) MICLASS - Classification and coding system.

b) Aggregate Planning.

c) Master Production Schedule

d) CAD/CAM integration

e) Cellular manufacturing system

SECTION - II

Q5) a) Discuss with neat sketches the various robotic configurations. [8]

b) What are four basic components of AS/RS (Automated storage and Retrieval system) [8]

Q6) a) Explain the functions of each layer in ISO - OSI reference model. [8]

b) Explain Manufacturing Automation Protocol (MAP) - [8]

Q7) a) Explain requirements of shop floor communication and hierarchy of computer communication used in CIM. [8]

b) Explain with neat sketches the different network topologies. [8]

Q8) Write short notes on (any three) [18]

a) Automated Guided Vehicles (AGV)

b) Role of Robots in CIMS

c) Monorail Vehicles

d) Computer Aided Quality control

e) DBMS in CIMS

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Seat
No.

T.E. (Mechanical) (Part - III) (Semester -VI) (Revised)
Examination, May - 2015
INTERNAL COMBUSTION ENGINES
Sub. Code:45570

Day and Date : Monday, 11 - 05 - 2015   **Total Marks : 100**
Time :2.30 p.m. to 5.30 p.m.

Instructions :   1)   Attempt any three questions from each section.

2)   Neat diagrams must be drawn wherever necessary.

3)   Make suitable assumptions if necessary and state it clearly.

SECTION - I

Q1) a) Define: **[8]**

i)   Mechanical Efficiency

ii)   Air standard efficiency

iii)   Brake thermal efficiency

iv)   Stroke

b)   Draw the PV diagram of valve port timing diagram for the 2 stroke petrol
engine.   **[8]**

Q2) a)   Derive the equation for air fuel ratio for simple carburetor with the effect
of compressibility.   **[8]**

b)   A six cylinder, 3.6 - liter SI engine is designed to have maximum speed
of 6000 RPM. At this speed the volumetric efficiency of the engine is
0.92. The engine will be equipped with two barrel carburetor, one for
low speeds and other for high speed. Gasoline density can be considered
to be 750 kg/m^3 calculate the throat diameters for the carburetor and fuel
capillary diameter (Cdt=0.94 &Cdc = 0.74)   **[10]**

ΔP = 49.47 Kpa (Across fuel jet), A/F = 15.2.

P.T.O.

Q3) a) Describe the phenomenon of detonation or knocking in SI engines. State the factors on which it depend? [8]

b) Waht is meant by supercharging? Describe the modification required for the conventional engine supercharging. [8]

Q4) a) Explain the deviation for thermodynamic actual and supercharged engine cycle. [6]

b) Describe the types of superchargers with neat sketch. [6]

c) How the engines are selected for power generation? [4]

SECTION - II

Q5) a) What is the purpose of using governor in C.I. engines? Explain with neat sketch principle of pneumatic governor. [8]

b) Which are the different types of solid injection system? Explain any one of them with neat sketch. [8]

Q6) a) Explain the phenomenon of diesel knock with P-θ curve. List the engine variables affect the diesel knock. [8]

b) List the different types of open combustion chambers. What are advantages and disadvantages of open combustion chamber? [8]

Q7) a) What is mean by heat balance sheet? What is use of the study of the heat balance of an engine. [7]

b) The following observations were recorded in a test of one hour duration on a single cylinder oil engine working on four stroke cycle. [10]

Bore = 300 mm

Stroke 450 mm

Fuel used =8.8 kg

C.V. of fuel = 41800 kJ/kg

Average speed = 200 rpm

Mean effective pressure (indicated) = 5.8 bar

Brake friction load = 1860 N

Temperature rise of cooling water = 22°C

Diameter of the brake wheel = 1.22 m

Quantity of cooling water = 650 kg

Calculate

i)   Mechanical efficiency

ii)   Brake thermal efficiency

iii) Draw the neat balance sheet.

Q8) Write short notes on any three: [18]

a)   Selection of I.C. engine for agriculture.

b)   Alcohole as a alternative fuel.

c)   S.I. engine emissions.

d) NO_x control from C.I. engine.

e)   Morse test.

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Seat
No.

T.E. (Mechanical Engg.) (Semester - VI) Examination, May - 2015
INDUSTRIAL FLUID POWER
Sub. Code : 45571

Day and Date : Wednesday 13 - 05 - 2015   Total Marks : 100
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) Answer three questions from each section in a single answer book.

2) Figures to the right indicate full marks to the questions.

3) Assume any data if necessary and state it clearly, Draw sketches wherever necessary.

SECTION - I

Q1) a) What are types of Hydraulic fluids? Explain their properties.   [8]

b) Explain with neat sketch working of axial piston pump.   [8]

Q2) a) Explain with neat sketch Meter in Circuit.   [8]

b) Explain Power pack with neat sketch.   [8]

Q3) a) Draw ISO symbols for following hydraulic circuit components.   [8]

i) 5/2 port solenoid operated DCV valve.

ii) Spring return hydraulic cylinder.

iii) Pressure reducing valve.

iv) Pneumatically piloted DCV valve.

b) Compare all types of hydraulic pumps for Principal, Power, Efficiency and Characteristic curves.   [8]

Q4) Write short notes on (any three) :

    a)   Hydraulic servo system for rotary motion.

    b)   Close center DCV.

    c)   Intensifier.

    d)   Calculation of piston velocity.

SECTION - II

Q5) a)   What are Physical Principles of pneumatics? Explain industrial application of Pneumatic systems.   [8]

    b)   Explain with neat sketch of FRL unit.   [8]

Q6) a)   Enlist selection criteria for air compressor and explain construction and working of Double acting linear actuator.   [8]

    b)   What is fluidics? Explain with neat sketch any two logic gates.   [8]

Q7) a)   Draw a neat sketch of Exhaust valve and speed regulator and explain their working.   [8]

    b)   Explain the troubleshooting and safety of hydro pneumatic.   [8]

Q8) Write short notes on (any three) :   [18]

    a)   Four way Pneumatic DCV.

    b)   Rotary Pneumatic actuator and its application.

    c)   Comparison of Hydraulic, Pneumatic and Electric motors.

    d)   Sources of contamination and its control in hydraulic system.

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Seat
No.

T.E. (Mechanical) (Part - II) (Semester - VI) (Revised) Examination, May - 2015

INDUSTRIAL MANAGEMENT & OPERATION RESEARCH

Sub. Code : 45573

Day and Date : Monday, 18 - 05 - 2015   **Total Marks : 100**

Time : 02.30 p.m. to 5.30 p.m.

Instructions: 1)   Question no 1 & Question no. 5 are compulsory and solve any two from remaining three questions from section - I & II.

           2)   Answers to the two sections must be written in two separate answer books only.

           3)   Figures to the right indicate full marks.

           4)   Assume suitable data if necessary and mention it clearly.

           5)   Draw neat labeled sketch wherever necessary.

           6)   Use of non programmable calculator is permissible.

SECTION - I

Q1) Attempt any four of the following.   [4 × 5 = 20]

   a)   What is planning? What are the advantages of planning?

   b)   Discuss the relationship between Authority and Responsibility

   c)   Define Training. State the objectives of Training and Development

   d)   What are the barriers to effective communication?

   e)   What is controlling? Discuss steps in controlling process.

Q2) a)   What is Marketing strategy? Explain the importance of 4P's in Marketing mix.

                                                                        [8]

   b)   Explain in detail the various objectives of Materials Management.   [7]

Q3) a)   What are the functions of purchase department? Explain 5-R principles of purchasing.   [8]

   b)   Explain the measures for preventing accidents in manufacturing industries.   [7]

Q4) a) Explain Management Information System. [8]

b) Discuss the Marketing and Financial assistance available to Small Scale Industry in our country. [7]

SECTION - II

Q5) Attempt any four of the following : [4 × 5 = 20]

a) Explain the various phases in solving O.R. problems.

b) What are the different methods of obtaining IBFS in transportation model? Explain anyone with an illustration.

c) List the various techniques for decision making under uncertainty. Explain Laplace criterion with an illustration.

d) State and explain mathematical model of assignment problem.

e) State optimality criteria & criteria for selecting entering & leaving variable. used in simplex algorithm.

f) State and explain basic elements of a queue.

Q6) a) Three buildings are to be added to a residential colony. Tenders are submitted by five contractors for all the buildings. But due to labour shortage and time schedule one building can be assigned to one contractor only. The tender figures in lakhs of Rs.are given below. [8]

		Buildings		
		A	B	C
	1	2.90	1.62	—
	2	3.10	1.75	2.81
Contractors	3	3.05	1.80	2.90.
	4	2.85	1.55	2.75
	5	—	1.70	3.00

The contractors 1 & 5 have not filled the tenders for the buildings C & A respectively. Find the assignment of buildings to the contractors that will result in minimum total cost for the building programme.

b) The unit cost of transportation from site i to site j is given below. At site 1, 2, 3 stocks of 150,200,170 units are available respectively. 300 units are to be sent to site 4 & rest to site 5. find the cheapest way to carry out the transportation. [7]

To Site j

From Site i	1	2	3	4	5
1	-	3	4	10	7
2	1	--	2	16	6
3	7	4	--	12	13
4	8	3	9	-	5
5	2	1	7	5	-

Q7) a) Explain following terms in context with LPP solutions by iterative method [8]

i) Standard form of LPP.

ii) Slack variable.

iii) Surplus variable.

iv) Basic variable.

v) Non-basic variable.

vi) Basic feasible solution

vii) Improved solution. .

viii) Optimum solution.

b) Solve the following LP problem graphically. [7]

i) Maximise $Z = 60 x_1 + 90 x_2$

$$x_1 + 2 x_2 \leq 40$$

$$2 x_1 + 3 x_2 \leq 90$$

$$x_1 - x_2 \geq 10$$

$$x_1, x_2 \geq 0$$

Q8) a) A contracter has a choice between two courses of action: (a) A risky contract promising Rs. 10 lakhs with a profitability of 0.6 and Rs. 6 lakhs with a profitability of 0.4. (b) A diversified portfolio consisting of two contracts with independent outcomes each paying Rs.5 lakhs with a profitability of 0.6 and Rs.3 lakhs with a profitability of 0.4. Construct a decision tree for using EMV criteria What is the optimal decision by using EMV criteria? [8]

b) Six jobs are to be processed on two machines A and then on machine B. Time in hours taken by each job on each machine is given below: [7]

	Jobs					
	1	2	3	4	5	6
Machine A	5	3	2	10	12	6
Machine B	3	2	5	11	10	7

Determine the optimum sequence of jobs that minimizes the total elapsed time to Complete the jobs and compute the minimum time.

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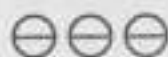
T.E. (Mech.) (Part -II) (Semester - VI) Examination, May - 2015
MACHINE DESIGN - II
Sub. Code : 45568

Day and Date : Wednesday, 06 - 05 - 2015　　　　　Total Marks : 100
Time : 02.30 p.m. to 05.30 p.m.

Instructions : 1)　Answer any three questions from section-I and any three questions from section-II.
　　　　　　　2)　Figures to the right indicate full marks.
　　　　　　　3)　Assume suitable data/assumption wherever necessary and mention them clearly.
　　　　　　　4)　Use of non-programmable calculator is permitted.
　　　　　　　5)　Draw neat diagrams wherever necessary.

SECTION - I

Q1) a)　Draw Soderberg, Goodman and Gerber lines and explain their significance in the design of fluctuating loads. 　　　　　　　[8]

　　　b)　A transmission shaft of cold drawn steel 27 Mn2 (S_{ut} = 500 N/mm² and S_{yt} = 300 N/mm²) is subjected to a fluctuating torque which varies from –100 N-m to + 400 N-m. The factor of safety is 2 and the expected reliability is 90%. Neglecting the effect of stress concentration, determine the diameter of shaft.

　　　　　Assume the distortion energy theory of failure. Take surface finish factor = 0.79, size factor = 0.85, reliability factor = 0.897. 　　[8]

Q2) a)　Explain with neat sketches the design considerations of castings　[8]

　　　b)　What is tribology? Discuss wear mechanism associated with tribology.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[8]

Q3) a) Explain the following terms in connection with rolling contact bearings.[8]

    i)   Static load capacity

    ii)   Dynamic load capacity

    iii) Equivalent load capacity

    iv) Load - Life relationship

  b) A deep groove ball bearing having bore diameter of 60 mm and rotating at 1440 rpm is subjected to radial force of 2500 N and an axial force of 1200 N. The radial and thrust factors are 0.56 and 2.0 respectively. The load factor is 1.2. The expected rating life is 25,000 hrs. Calculate the required dynamic load capacity and select the bearing from manufacturer's catalogue given below in table no-1.   [8]

Table no. 1

Principal Dimensions				Basic Capacity	
Bearing No.	Bore Dia 'd' mm	Outside Dia 'D' mm	Width B' mm	Static 'Co' kN	Dynamic 'C' kN
6012	60	95	18	23.20	29.60
6212	60	110	22	32.50	47.50
6312	60	130	31	52.00	81.90
6412	60	150	35	69.50	108.00

Q4) a) With neat sketches, describer construction and working principles of hydrodynamic and hydrostatic bearings. [8]

b) The following data is given for a full hydrodynamic bearing used for electric motor [10]

radial load = 1.2 kN

journal speed = 1440 rpm

journal diameter = 50 mm

bearing length =25 mm

radial clearance = 0.025 mm

viscosity of lubricant = 31.16 cP

Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate

i) coefficient of friction

ii) power lost in friction

iii) min oil film thickness

iv) flow requirement in litres/min

v) Temperature rise

Refer the following table .2

Table .2   Dimensionless performance parameters for full journal bearing with side flow

$\left(\frac{l}{d}\right)$	ε	$\left(\frac{h_0}{c}\right)$	S	ϕ	$\left(\frac{r}{c}\right)f$	$\left(\frac{Q}{rcn_s l}\right)$	$\left(\frac{Q_s}{Q}\right)$	$\left(\frac{P}{P_{max}}\right)$
∞	0	1.0	∞	(70.92)	∞	π	0	—
	0.1	0.9	0.240	69.10	4.80	3.03	0	0.826
	0.2	0.8	0.123	67.26	2.57	2.83	0	0.814
	0.4	0.6	0.0626	61.94	1.52	2.26	0	0.764
	0.6	0.4	0.0389	54.31	1.20	1.56	0	0.667
	0.8	0.2	0.021	42.22	0.961	0.760	0	0.495
	0.9	0.1	0.0115	31.62	0.756	0.411	0	0.358
	0.97	0.03	—	—	—	—	0	—
	1.0	0	0	0	0	0	0	0
1	0	1.0	∞	(85)	∞	π	0	—
	0.1	0.9	1.33	79.5	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	74.02	12.8	3.59	0.280	0.529
	0.4	0.6	0.264	63.10	5.79	3.99	0.497	0.484
	0.6	0.4	0.121	50.58	3.22	4.33	0.680	0.415
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	26.45	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	15.47	0.514	4.82	0.973	0.152
	1.0	0	0	0	0	0	1.0	0
$\left(\frac{1}{2}\right)$	0	1.0	∞	(88.5)	∞	π	0	—
	0.1	0.9	4.31	81.62	85.6	3.43	0.173	0.523
	0.2	0.8	2.03	74.94	40.9	3.72	0.318	0.506
	0.4	0.6	0.779	61.45	17.0	4.29	0.552	0.441
	0.6	0.4	0.319	48.14	8.10	4.85	0.730	0.365
	0.8	0.2	0.0923	33.31	3.26	5.41	0.874	0.267
	0.9	0.1	0.0313	23.66	1.60	5.69	0.939	0.206
	0.97	0.03	0.00609	13.75	0.610	5.88	0.980	0.126
	1.0	0	0	0	0	—	1.0	0
$\left(\frac{1}{4}\right)$	0	1.0	∞	(89.5)	∞	π	0	—
	0.1	0.9	16.2	82.31	322.0	3.45	0.180	0.515
	0.2	0.8	7.57	75.18	153.0	3.76	0.330	0.489
	0.4	0.6	2.83	60.86	61.1	4.37	0.567	0.415
	0.6	0.4	1.07	46.72	26.7	4.99	0.746	0.334
	0.8	0.2	0.261	31.04	8.8	5.60	0.884	0.240
	0.9	0.1	0.0736	21.85	3.50	5.91	0.945	0.180
	0.97	0.03	0.0101	12.22	0.922	6.12	0.984	0.108
	1.0	0	0	0	0	—	1.0	0

SECTION - II

Q5) a) Explain the different types of gear teeth failure and state their causes and remedies. [6]

b) Design a pair of spur gears with 20° full depth involute teeth based on Lewis equation Consist of a 24 teeth pinion meshing with a 48 teeth gear. The module is 6 mm and face width is 60 mm. The pinion rotates at 1000 rpm.The factor of safety and service factor may taken as 1.5 and 2.0 respectively. The pinion and gear are made of steel (Sut=450 N/mm²).The gears are heat treated to surface hardness of 250 BHN.The gears are made to accuracy of grade 8. Calculate : [10]

i) beam strength

ii) wear strength

iii) dynamic load by Spott's equation

iv) rated power that the gear can transmit. For grade 8, $e = 16 + 1.25(m + 0.25\sqrt{d})$ μm, d-pitch circle diameter in mm.

Q6) a) Explain with neat sketch the concept of formative number of teeth in helical gear. [6]

b) Calculate the power transmitting capacity of a pair of helical gear consisting of a 20 teeth pinion meshing with 100 teeth gear. The pinion rotates at 720 rpm. The normal module and face width is 4 mm and 40 mm. The normal pressure angle is 20° while the helix angle is 23°. Both the gears are made of steel with Sut=600N/mm^2 and heat treated to a surface hardness of 300 BHN. Take C$_s$=1.5 and factor of safety is 2. Assume that the velocity factor to account for the dynamic load. [10]

No. of teeth	20	21	22	23	24	25	26	27
Y	0.32	0.326	0.33	0.333	0.337	0.34	0.344	0.348

Q7) a) Explain with neat sketch the following terms in the design of bevel gear [8]

i) Cone Distance

ii) Pitch Angle for pinion and Gear

iii) Face Width

iv) Back Cone

b) Design a pair of bevel gears with 20° full depth involute systemconsists of a 24 teeth pinion meshing with a 48 teeth gear. The module is 6 mm and face width is 50 mm.The gears are made of grey cast iron (Sut=220 N/mm²).The teeth are generated and assume that the velocity factor is to be used to account for dynamic loadThe pinion rotates at 300 rpm.The factor of safety and service factor may taken as 1.5 and 2.0 respectively. Calculate: [10]

i) Beam strength

ii) static load for bending consideration

iii) rated power that the gear can transmit.

Q8) a) Derive an expression for efficiency of worm and worm wheel gearing.

[6]

b) Explain with neat sketch force analysis in worm and worm wheel gearing. [10]

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T.E. (Mechanical) (Part - II) (Semester - VI) Examination, April - 2016

MACHINE DESIGN - II

Sub. Code : 45568

Day and Date : Saturday, 16 - 04 - 2016

Time : 03.00 p.m. to 06.00 p.m.

Total Marks : 100

Instructions :
1) Answer any three question from section - I and three questions from section - II.
2) Assume suitable data/assumption wherever necessary and mention them clearly.
3) Use of non-programmable calculator is permitted.
4) Figures to the right indicate full marks.

SECTION - I

Q1) a) Define stress concentration. What are the causes and remedies over stress concentration? [8]

b) A solid circular shaft, 15 mm in diameter, is subjected to torsional shear stress, which varies from 0 to 35 N/mm² and at the same time, is subjected to an axial stress that varies from – 15 to + 30 N/mm². The frequency of variation of these stresses is equal to the shaft speed. The shaft is made up of steel FeF. 400 (S_{ut} = 540 N/mm² and S_{yt} = 400 N/mm²) and the corrected endurance strength of shaft is 200 N/mm². Determine the factor of safety. [8]

Q2) a) Explain with neat sketches the design consideration of forging. [8]

b) Explain different wear mechanisms associated with tribology. [8]

Q3) a) State the selection procedure of ball bearing from Manufacturer's catalogue. [8]

b) A deep-groove ball bearing having bore diameter of 60 mm and rotating at 1440 r.p.m. is subjected to radial force of 2500 N and an axial force of 1200 N. The radial and thrust factors are 0.56 and 2.0 respectively. The load factor is 1.2. The expected rating life is 25000 Hrs. Calculate the required dynamic load capacity and select the bearing from manufacturer's catalogue given below in the table no. 1. [8]

Table No. 1

Principal Dimensions				Basic Capacity	
Bearing No.	Bore Dia 'd' mm	Outside Dia 'D' mm	Width 'B' mm	Static 'Co' kN	Dynamic 'C' kN
6012	60	95	18	23.20	29.60
6212	60	110	22	32.50	47.50
6312	60	130	31	52.00	81.90
6412	60	150	35	69.50	108.00

Q4) a) With neat sketches, describe construction and working principles of hydrodynamic and hydrostatic bearings. [8]

b) Following data is given for a 360° hydrodynamic bearing. [10]

Journal diameter   = 100 mm

Bearing length   = 100 mm

Radial load   = 50 kN

Journal speed   = 1440 r.p.m.

Radial clearance   = 0.12 mm

Viscosity of lubricant = 16 cP

Calculate :

     i)   Minimum film thickness

     ii)   Coefficient of friction and

     iii)   Power lost in friction

Refer following table no. 2

Table No. 2.

$\left(\dfrac{l}{d}\right)$	ε	$\left(\dfrac{h_0}{c}\right)$	s	ϕ	$\left(\dfrac{r}{c}\right)f$	$\left(\dfrac{Q}{rcn_sl}\right)$	$\left(\dfrac{Q_s}{Q}\right)$	$\left(\dfrac{p}{p_{max.}}\right)$
1	0	1.0	∞	(85)	∞	π	0	–
	0.1	0.9	1.33	79.5	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	74.02	12.8	3.59	0.280	0.529
	0.4	0.6	0.264	63.10	5.79	3.99	0.497	0.484
	0.6	0.4	0.121	50.58	3.22	4.33	0.680	0.415
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	26.45	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	15.47	0.514	4.82	0.973	0.152
	1.0	0	0	0	0	0	1.0	0

SECTION - II

Q5) a) Explain the different materials used for gear manufacturing. Specify their field of application. **[6]**

b) Determine the rated power that can transmit in a pair of spur gears with $20°$ full depth involute teeth based on Lewis equation. The pinion with 20 teeth rotates at 1450 rpm and meshing with a 41 teeth gear. The module is 3 mm and face width is 40 mm. The factor of safety and service factor may taken as 1.75 and 1.5 respectively. The pinion and gear are made of steel ($S_{ut} = 600$ N/mm^2). The gears are heat treated to surface hardness of 400 BHN. The gears are made to accuracy of grade 8.

For grade 8, $e = 16 + 1.25 (m + 0.25 \sqrt{d})$ μm, d-pitch circle diameter in mm. **[10]**

Q6) a) Explain with neat sketch force analysis in design helical gear. **[6]**

b) Calculate the power transmitting capacity of a pair of helical gear consisting of a 20 teeth pinion meshing with 100 teeth gear. The pinion rotates at 720 rpm. The normal module and face width is 4 mm and 40 mm. The normal pressure angle is $20°$, while the helix angle is $23°$. Both the gears are made of steel with $S_{ut} = 600$ N/mm^2 and heat treated to a surface hardness of 300 BHN. Take $C_s = 1.5$ and factor of safety is 2. Assume that the velocity factor to account for the dynamic load. **[10]**

No. of teeth	20	21	22	23	24	25	26	27
Y	0.32	0.326	0.33	0.333	0.337	0.34	0.344	0.348

Q7) a)   Derive an expression for the beam strength of bevel gear.   [6]

b)   Design a pair of bevel gears with 20° full depth involute system consists of a 24 teeth pinion meshing with a 48 teeth gear. The module is 6 mm and face width is 50 mm. The gears are made of grey cast iron (S_{ut} = 220 N/mm²). The teeth are generated and assume that the velocity factor is to be used to account for dynamic load. The pinion rotates at 300 rpm. The factor of safety and service factor may taken as 1.5 and 2.0 respectively. Calculate:

   i)   Beam strength

   ii)   Static load for bending consideration

   iii)   Rated power that the gear can transmit   [12]

Q8) a)   Derive an expression for efficiency of worm and worm wheel gearing. [6]

b)   A pair of worm and worm wheel gearing is designated as 1/40/10/4. [10]
       Determine:

   i)   Center Distance

   ii)   Speed reduction

   iii)   Dimensions of Worm

   iv)   Dimensions of Worm Wheel

T.E. (Mech.) (Part - III) (Semester - VI) Examination, April - 2016
RENEWABLE ENERGY ENGINEERING
Sub. Code : 45569

Day and Date : Monday, 18 - 04 - 2016   Total Marks : 100
Time : 03.00 p.m. to 06.00 p.m.

Instructions :   1)   Solve any three questions from each section.
2)   Figures to the right indicate full marks.
3)   Assume data if necessary.

SECTION - I

Q1) a)   Discuss in detail the world scenario of fossil fuels.   [8]

b)   Describe the present status of renewable energy sources in India.   [8]

Q2) a)   Explain the procedure for testing of solar collectors.   [8]

b)   Discuss the types of solar energy storage systems.   [8]

Q3) a)   Explain the principle of solar PV-cell. State its advantages and
disadvantages.   [8]

b)   Discuss the different types of photo cell materials.   [8]

Q4) Write short notes. (Any Three)   [18]

a)   Solar cooker

b)   Solar radiation data

c)   Fuel cells

d)   Solar pond

SECTION - II

Q5) a) Explain the working of vertical wind mill with neat sketch. [8]

b) Discuss the selection criteria for wind energy site. [8]

Q6) a) Describe the biogas plant with neat sketch. State its advantages. [8]

b) Discuss the pyrolysis process with suitable sketch. [8]

Q7) a) Explain the working of closed cycle OTEC system with suitable sketch.[8]

b) Discuss the working of geothermal power plant and state advantages.[8]

Q8) Write short notes. (Any Three) [18]

a) Diesel-PV hybrid systems

b) Energy planning

c) Energy Audit

d) ECOs

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Seat
No.

T.E. (Mechanical) (Semester - VI) Examination, April - 2016
I.C. ENGINES
Sub. Code : 45570

Day and Date : Thursday, 21 - 04 - 2016   Total Marks : 100

Time : 03.00 p.m. to 06.00 p.m.

Instructions :
1) Solve any three questions from section I and any three questions from section II.
2) Figures to the right indicate full marks.
3) Draw neat sketches wherever necessary.
4) Answer to the two sections must be written on same answer book.
5) Assume suitable data if required.

SECTION - I

Q1) a) Classify I.C. Engine with respect to types and applications. [4]

b) Explain why efficiency of actual cycle is lower than air standard cycle efficiency. [5]

c) Explain with neat sketch port timing diagram of two stroke engine. [8]

Q2) a) Explain with neat sketch working of electronic fuel injection system. [6]

b) A 4-cylinder, 4 stroke engine has a capacity of 1490 cm³ develops maximum power at 4200 rpm and with A:F ratio 13:1. The air speed at venturi is 90 m/sec. Calculate diameter of venturi and fuel nozzle if volumetric efficiency of engine is 70%, Cd for venturi 0.85, Cdf for fuel nozzle 0.66, density of fuel 740 kg/m³ and h for nozzle is 6 mm. The atmospheric pressure and temperature is 1.013 bar and 293 k. [10]

Q3) a) Explain with P.Q diagram stages of combustion in S.I. engine. List factors affecting flame speed. [8]

b) List and explain characteristics of good combustion chamber. What are various types of combustion chambers used in S.I. engine. [9]

P.T.O.

[16]

Q4) Write notes on any four.

a) Effect of turbocharging on C.I. engine performance.

b) Effect of supercharging on S.I. engine performance.

c) Limitations of supercharging.

d) Abnormal combustion in S.I. engine.

e) Causes of Ignition lag.

f) Mixture quality supplied by simple carburator.

g) Preignition in S.I. engines.

SECTION - II

Q5) a) Which are the different types of fuel Injection systems? With neat sketches explain common rail system in detail. [8]

b) With neat sketches explain construction and working of automatic injector. [8]

Q6) a) Explain the combustion stages in C.I. Engines with the help of P.Q. curve. [8]

b) Explain in detail variables affecting delay period in combustion of C.I. Engine. [8]

Q7) a) Explain Morse Test in detail. [6]

b) The following observations were recorded during a trial of a four stroke, single-cylinder oil engine. Duration of trial is 30 min; oil consumption is 4 litres; calorific value of oil is 43 MJ/ kg; specific gravity of fuel = 0.8; average area of the indicator diagram = 8.5 cm²; Length of the indicator diagram = 8.5 cm; spring constant = 5.5 bar / cm; brake load = 150 kg; spring balance reading = 20 kg; effective brake wheel diameter = 1.5 m; speed = 200 rpm; cylinder- diameter = 30 cm; stroke = 45 cm; jacket cooling water = 10 kg/min; temperature rise is 36°C. [12]

Calculate :

i) Indicated power

ii) Brake power

iii) Mechanical efficiency

iv) Brake specific fuel consumption in kg/kW h and

v) Indicated thermal efficiency

Q8) Write short notes on any four. [16]

a) Alternative fuels for S.I. Engine.

b) Governing of C.I. Engine.

c) Sources of pollution from a S.I. Engine.

d) Selection of engine for Air craft.

e) Electronic diesel injection system.

g) Catalytic Converters.

T.E. (Mechanical) (Semester - VI) (Pre-Revised) Examination, April - 2016

INDUSTRIAL FLUID POWER

Sub. Code : 45571

Day and Date : Saturday, 23 - 04 - 2016

Time : 03.00 p.m. to 06.00 p.m.

Total Marks : 100

Instructions :
1) Solve any three questions from each section.
2) Make suitable assumptions if required and state it clearly.
3) Draw neat sketches wherever necessary.

SECTION - I

Q1) a) Discuss in detail various applications of fluid power systems. [8]

b) Elaborate various types of seals used in hydraulics and discuss their features. [8]

Q2) a) Classify hydraulic pumps. Explain with neat sketch construction and working of external gear pump. [8]

b) What are the different sources of contamination in hydraulic fluids, elaborates in detail? [8]

Q3) a) Draw ISO/JIC symbols for following elements: [10]

i) Hydraulic motor

ii) Pressure relief valve

iii) Heater

iv) 4/3 electrical solenoid operated DC Valve

v) Spring loaded accumulator

b) Classify hydraulic actuators. Explain any one of them with neat sketch along with its application. [8]

Q4) a) Explain with neat sketch Meter in and meter out circuits with its application. [8]

b) Classify control valves used in hydraulics and explain construction and working of any pressure control valve. [8]

SECTION - II

Q5) a) Why FRL system is essential in pneumatic system? Explain working of the same with neat sketch of each. [8]

b) Classify air compressors and explain working of any compressor with a neat sketch. [8]

Q6) a) What do you understand by cylinder cushioning? Explain working of cylinder cushioning with neat sketch. [8]

b) Explain with neat sketch working of time delay valve used in pneumatics. [8]

Q7) a) Draw a pneumatic circuit for pilot control of single acting cylinder using appropriate ISO symbols and explain its working. [8]

b) What are the general guidelines for maintenance and trouble shooting of pneumatic system. [8]

Q8) Write a short note on. (Any Three) $[3 \times 6 = 18]$

a) Air motors

b) Quick exhaust valve

c) Pneumatic sensors

d) Industrial application of pneumatics

e) Comparison of hydraulic and pneumatic system

Seat
No.

T.E. (Mech.) (Part -III) (Semester - VI) (Revised) Examination, April - 2016

COMPUTER INTEGRATED MANUFACTURING

Sub. Code : 45572

Day and Date : Monday, 25 - 04 - 2016   Total Marks : 100

Time : 03.00 p.m. to 06.00 p.m.

Instructions :   1)   Figures to the right indicate full marks.

                   2)   Answer three questions from each section.

                   3)   Draw neat sketch wherever necessary.

                   4)   Assume data if necessary and mention clearly.

                   5)   Answers to two sections must be written in one answer sheet.

SECTION - I

Q1) a) Discuss the main elements of CIM and mention obstacles in CIM implementation.   [8]

b) What are the stages in product design? Explain the role of computers in it.   [8]

Q2) a) Explain the procedure to implement Group Technology.   [8]

b) State advantages of FMS and differentiate between rigid and flexible manufacturing.   [8]

Q3) a) Explain with diagram master production schedule.   [8]

b) State and explain various factory data collection systems.   [8]

Q4) Write short notes on (any three) :   [18]

a) Cellular manufacturing

b) Integration of CAD/CAM

c) OPTIZ classification system

d) Methods of computer aided processes planning

SECTION - II

Q5) a) Explain types, applications of CMM. Write specifications, features of a coordinate measuring Machine. **[8]**

b) Describe different inspection systems used in CIM environment. **[8]**

Q6) a) Discuss with neat sketches the various robotic configurations. **[8]**

b) What are basic components of AS/RS. Explain AS/RS control. **[8]**

Q7) a) What are the networking concepts used in CIMS? Discuss the significance of networking in CIMS. **[8]**

b) Discuss in brief the phases of CIMS implementation. **[8]**

Q8) Write short notes on (any three) : **[18]**

a) Design requirements of DBMS in CIMS

b) Organization for CIM planning and implementation

c) Types of DBMS models in CIMS

d) Need and steps of planning in CIMS

e) Scope of DBMS in CIMS

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T.E. (Mechanical) (Part - III) (Semester - VI) Examination,
April - 2016
INDUSTRIAL MANAGEMENT & OPERATIONS RESEARCH
Sub. Code : 45573

Day and Date : Wednesday, 27 - 04 - 2016

Time : 3.00 p.m. to 06.00 p.m.

Total Marks : 100

Instructions :
1) Attempt any three questions each from section I & II.
2) Use of non-programmable calculator is allowed.
3) Figures to the right indicate full marks.
4) Make suitable assumptions for missing data and state them clearly.

SECTION - I

Q1) a) State both internal and external environmental factors influencing an automotive industry. And explain any one external factor in detail. **[8]**

b) "Planning is a pre - predetermined course of action to achieve the objectives of the company" Comment on the statement. Differentiate between strategic and operational planning. **[8]**

Q2) a) State the leadership styles and under what situations you recommend each of these styles. Explain any one style briefly with merits and demerits. **[8]**

b) A software company wants to recruit fresh graduates for their explansion project. They are looking for best young talent from across India. Suggest how the company should go about recruitment. Give the systematic steps you recommend ot the company. **[8]**

Q3) a) Justify the need for segmenting the market. Explain the basis of segmentation for the following product and name the segments with brief characteristics of the segments. (Any One). **[8]**
   i) Mobile phones
   ii) Tooth paste
   iii) Two wheelers

b) A women entrepreneur is interested to start a Baby Care Centre (Palana Ghar) business professionally in Islampur and wants to know the feasibility of the service. Explain how she should go about conducting the marketing research. Start from objectives, clearly explain the methodology. [8]

Q4) Attempt any two.

a) A purchase department of an automobile manufacturing company purchase tires from MRF company for its cars. Explain the steps in purchasing tires. How does the company measure the performance of purchasing department? [9]

b) An engineering graduate wants to start an Automobile Servicing Center for four wheelers. How he should establish the feasibility for the project. Explain the steps how he should go about strarting his own service centre. [9]

c) Analyse the personality characteristics of a successful entrepreneur. Whom do you look to as a role model as an entrepreneur? Justify your choice with reasoning. [9]

d) Analyse the reasons for industrial accidents? Recommend remedial measures to prevent accidents. [9]

SECTION - II

Q5) a) A firm manufactures 3 products A,B,C. The profits per unit product are Rs. 3,Rs.2 and Rs.4 respectively. The firm has two machines and the required processing time in minutes for each machine on each product is given below. [4]

Product

Machine

	A	B	C
X	4	3	3
Y	2	2	4

Machines X and Y have 2000 and 1500 machine minutes respectively. The firm must manufacture 100 A's, 200B's and 50C's but not more than 150 A's, Formulate a linear programming model to maximize the profit.

b) Solve the following graphically. [6]

Maximize $Z = 2x_1 + 3x_2$

Subject to $x_1 + x_2 \leq 30$

$x_2 \geq 3$

$x_2 \leq 12$

$x_1 - x_2 \geq 0$

$0 \leq x_1 \leq 20$

$x_1, x_2 \geq 0$

c) Explain the following with respect to linear programming problem. [6]

i) Initial or starting solution

ii) Entering and leaving variable

Q6) a) Solve the following LPP by simplex method. [10]

Maximize $Z = 10x_1 + 15x_2 + 20x_3$

Subject to $2x_1 + 4x_2 + 6x_3 \leq 24$

$3x_1 + 9x_2 + 6x_3 \leq 30$

$x_1, x_2, x_3 \geq 0$

b) A company has taken third floor of a multi-storeyed building for rent with a view to locate one of their zonal offices. There are five rooms in this to be assigned to five managers. Each of the five managers was asked to rank their room preferences amongst the rooms 301, 302, 303, 304, 305. Their preferences were recorded in the table indicated below. Find out as to which manager should be assigned to which room so that their total preference ranking is minimum. [8]

Managers

M1	M2	M3	M4	M5
302	302	303	302	301
303	304	301	305	302
304	305	304	304	304
-	301	305	303	-
-	-	302	-	-

Q7) a) What is degeneracy in Transportation problem? How to resolve it? **[6]**

b) Find the optimum solution to the following transportation problem in which the cells contain the transportation cost in rupees. **[10]**

	W1	W2	W3	W4	W5	Supply
F1	7	6	4	5	9	40
F2	8	5	6	7	8	30
F3	6	8	9	6	5	20
F4	5	7	7	8	6	10
Demand	30	30	15	20	5	

Q8) a) Seven jobs are to be processed on two machines A and B in the order A-B. Each machine can process only one job at a time. The processing times (in hours) are as follows. Find total elapsed time and idle time for both machines. **[8]**

Job	1	2	3	4	5	6	7
M/c A	10	12	13	7	14	5	16
M/c B	15	11	8	9	6	7	16

b) Write short notes on (Any Two) **[8]**

i) Travelling salesman problem

ii) Decisions under uncertainty

iii) Queuing Model

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Seat
No.

T.E. (Mechanical) (Semester - VI) Examination, April - 2016
MACHINE DESIGN - II (Revised)
Sub. Code : 66840

Day and Date : Saturday, 23 - 04 - 2016   **Total Marks : 100**

Time : 03.00 p.m. to 06.00 p.m.

Instructions :   1)   Figures to the right indicate full marks.

   2)   Assume suitable data wherever necessary.

   3)   Use of Non-programmable calculator is allowed.

Q1) a)   Define fluctuating stress. Explain in details the reasons for fatigue failure.
[8]

OR

a)   Explain process of fatigue design of shaft under combined stresses. [8]

b)   A polished steel bar is subjected to axial tensile force that varies from
zero to P_{max}. It has a groove 2 mm deep and having a radius of 3mm. The
theoretical stress concentration factor and notch sensitivity factor at the
groove are 1.8 and 0.95 respectively. The outer diameter of the bar is 30
mm. The ultimate tensile strength of the bar is 1250 MPa. The endurance
limit in reversed bending is 600 MPa. Find the maximum force that the
bar can carry for 10^5 cycles with 90% reliability.   [10]
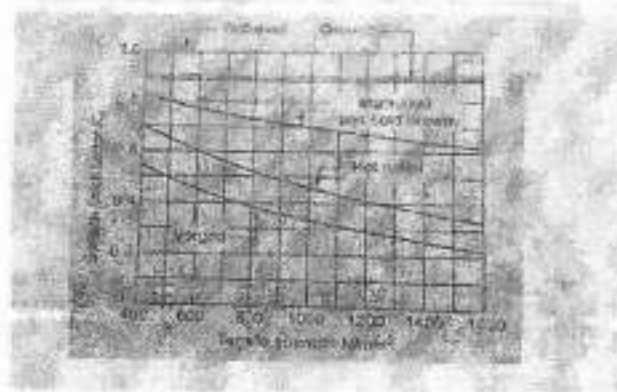
Use fig. 1 to 3 for related data.

Fig 1: Surface Finish Factor

Diameter (d) (mm)	K_b
$d \leq 7.5$	1.00
$7.5 < d \leq 50$	0.85
$d > 50$	0.75

Fig.2 : Values of size factor

Reliability R(%)	K_c
50	1.00
90	0.897
95	0.868
99	0.814
99.9	0.753
99.99	0.659

Fig.3: Reliability factor

Q2) a) Explain the general principles of design for forging. [8]

OR

a) Explain the role of friction, wear and lubrication in the design of bearings. [8]

b) Select the ball bearing for a shaft of an electric motor having step diameter 50mm 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. Use following reference table. [8]

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

Q3) a) Explain the following terms related to hydrodynamic bearings. [6]
   i) Sommerfield number
   ii) Minimum oil film thickness
   iii) Temperature rise
   iv) Eccentricity ratio

OR

a) Explain Reynold's equation along with the assumptions considered. [6

b) The following data is given for a 360° hydrodynamic bearing. [10
Radial load = 30kN
Journal diameter = 75 mm
Bearing length = 75 mm
Journal speed = 3600 rpm
Radial clearance = 0.15 mm
Inlet temperature = 40°C

The temperature-viscosity relationship is as follows.

T(°C)	40	41	42	43	44	45	46	47	48	49	5(
z(cP)	52.5	50	47.5	45	43	41	39	37.5	36	34	33

Assume that the total heat produced in the bearing is carried out by the total oil flow. The specific gravity and specific heat of the lubricant are 0.86 and 1.76 kJ/kg°C respectively. Calculate the power lost in friction and the requirement of oil flow.

Use Fig. 4 for data.

l/d	ε	h0/C	S	φ	(r/C)f	Q/(rCn$_s$l)
1	0.4	0.6	0.264	63.10	5.79	3.99
	0.6	0.4	0.121	50.58	3.22	4.33
	0.8	0.2	0.0446	36.24	1.70	4.62
	0.9	0.1	0.0188	26.45	1.05	4.74
	0.97	0.03	0.0047	15.47	0.514	4.82

Fig.4

Q4) a) Explain the term static and dynamic loads on geat tooth. Describe various parameters which contribute dynamic load. [7]

OR

b) Derive an expression for the wear strength of spur gear. [7]

c) Design a pair of spur gears with 20° full depth involute teeth consisting of a 20 teeth pinion meshing with 50 teeth gear. The pinion shaft is connected to a 22.5 KW, 1450 rpm electric motor. The starting torque of the motor can be taken as 150% of rated torque. The material for pinion is plain carbon steel Fe 410 (S_{ut} =410 N/mm²) while the gear is made of grey cast iron FG 200 (S_{ut} = 200 N/mm²). The factor safery is 1.5. Design the gears based on Lewis equation and using velocity factor to account for the dynamic load. Lewis form factor for 20 teeth, Y = 0.32 and for 50 teeth, Y = 0.408. Assume C_v = Velocity factor = 3 / (3+V), V in m/s.[11]

Q5) a) A pair of parallel helical gears with consisting of a 24 teeth pinion meshing with 120 teeth gear. The helix angle is 25° and the normal pressure angle is 20° . The normal module is 4mm and the face width is 40 mm. The pinion rotates at 720rpm. The materials for the pinion and gear are made of steel 40C$_8$ (S$_{ut}$ = 600 N/mm^2) and heat treated to surface hardness of 350 BHN Take C$_s$ = 1.5 and factor of safety as 2.Assume that the velocity factor for accounts for the dynamic load. Take Y for 32 teeth = 0.364 and for 33 teeth = 0.367. Determine the power transmitting capacity of the gears.[10]

OR

b) A pair of straight bevel gears consists of a 24 teeth pinion meshing with a 48 teeth gear. The module at the outside diameter is 6 mm and face width is 50 mm.The gears are made of grey cast iron FG 220 (S$_{ut}$=220N/mm^2) The pressure angle is 20°.The teeth are generated and assume that velocity factor accounts for the dynamic load. The pinion rotates at 300 rpm and the service factor is 1.5. Use Y for 26 teeth = 0.344 and Y for 27 teeth = 0.348. Determine:-i) Beam strength ii) The static load that the gears can transmit with factor of safety of 2 for bending consideration. iii) The rated power that the gears can transmit. [10]

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

26) a) Explain with neat sketch force analysis of bevel gear. [8]

OR

b) Explain beam strength rating of worm gear drive. [8]

c) A pair of worm gear is designated as 2/ 54/10/5.Determine: [8]
   i)   the center distance
   ii) the speed reduction
   iii) the dimensions of the worm
   iv) the dimensions of the worm wheel

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-4-

Seat No.

T.E. (Mechanical) (Part - II) (Semester - VI) (Revised) (New) Examination, April - 2016
INDUSTRIAL MANAGEMENT & OPERATIONS RESEARCH
Sub. Code: 66837

Day and Date : Saturday, 16 - 04 - 2016   Total Marks : 100
Time : 3.00 p.m. to 6.00 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data if necessary.
4) All questions are to be solved on one answer book only.

Q1) Attempt any four (5 Marks Each):   [20]

   a) Management is both the art and a science. Discuss with examples.

   b) Explain various principles of organizations.

   c) Write activities involved in human resource management.

   d) Distinguish between X and Y theory of motivation.

   e) What are the steps in basic control process?

Q2) Attempt any four (5 Marks Each):   [20]

   a) Differentiate between selling and marketing concept.

   b) Classify markets on different basis with examples.

   c) State elements of cost.

   d) Explain in brief scientific purchasing procedure.

   e) Discuss the objectives of material management.

Q3) Attempt any two (5 Marks Each):   [10]

   a) Draw the block diagram of MIS and explain in brief.

   b) Write steps in ISO 9000 implementation steps.

   c) State the measures to prevent fire accidents.

Q4) Attempt any three (5 Marks Each): [15]

a) Discuss various phases in solving an operation research problem.

b) A plant manufactures washing machines and dryers. The major manufacturing departments are the stamping department, motor and transmission department and assembly department. The first two departments produce parts for both the products while the assembly lines are different for the two products. The monthly departmental capacities are

Stamping department. : 1,000 washers or 1,000 dryers

Motor and transmission department. : 1,600 washers of 7,000 dryers

Washer assembly line: 9,000 washers only

Dryer assembly line: 5,000 dryers only.

Profits per piece of washers and dryers are Rs. 270 and Rs. 300 respectively.

Formulate the L.P. model.

c) Use graphical method to solve the following.

Maximize $Z = 120x_1 + 100x_2$

subjected to constraints,

$$10x_1 + 5x_2 \le 80,$$
$$6x_1 + 6x_2 \le 66$$
$$4x_1 + 8x_2 \ge 24$$
$$5x_1 + 6x_2 \le 90$$
$$x_1, x_2 \ge 0.$$

d) Write dual of above linear programming problem.

Q5) Attempt any three (5 Marks Each): [15]

a) Write a short note on degeneracy in transportation problem.

b) The initial basic feasible solution for a transportation problem is as given below

Supplier	Restaurant				Capacity
	1	2	3	4	
A	11	13	10	0	30,000
			30,000		
B	15	13	16	0	70,000
		60,000	10,000		
C	14	13	18	0	1,35,000
	30,000		80,000	25,000	
Requirements	30,000	60,000	1,20,000	25,000	

Obtain optimal allocation by using MODI method.

c) A workshop has four machines and four tasks for completion. Each of the machines can perform each of the tasks. time taken for each of the machines to complete each of the tasks is given in the matrix below. How the task should be assigned to machines to minimize machine hrs.

Task	Machines			
	A	B	C	D
1	51	77	49	55
2	32	34	59	68
3	37	44	70	54
4	55	55	58	55

d) A pharmaceutical company has four branches one each at city A,B,C and D. A branch manager is to be appointed one at each city, out of four candidates P, Q,R and S. The monthly business (Rs. in lakh) depends on the city and effectiveness of branch manager. assign branch suitable Manager to suitable city

Branch manager	City			
	A	B	C	D
P	11	11	9	9
Q	13	16	11	10
R	12	17	13	8
S	16	14	16	12

6) Attempt any four (5 Marks Each): [20]

a) Differentiate between CPM and PERT.

b) Draw the project network for the following activities and determine critical path.

Activity	A	B	C	D	E	F	G	H	I
Preceding activity	-	B	B	C	D	B	B	G	E,F,H
Duration	7	7	2	4	7	5	7	7	2

c) A departmental store purchases Christmas trees which can be ordered in lots of 100 only. Each tree cost Rs. 25 and sells at Rs. 40 each. Unsold trees however no salvage value. The probability of sell is as given below.

Trees sold	100	200	300
probability	0.45	0.40	0.15

How much trees should be bought.

d) A firm owner is considering drilling a well. In the past only 70% of wells had water at a depth of 200 ft. on finding no water at a depth of 200 ft. some farmers drilled further up to 250 ft. but only 20% struck water? The cost of drilling is Rs. 50 per ft. the farmer estimates that if he does not have his own well he has to pay Rs. 15000 to buy water from his neighbor. Draw the decision tree and take decision.

e) Determine optimal sequence, elapsed time and idle time (in hrs.) of the following six jobs on the machine 1 and 2 used in the same sequence to process these jobs.

Job	J1	J2	J3	J4	J5	J6
Machine 1	15	14	16	13	10	8
Machine 2	8	10	7	15	11	9

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Seat
No.

T.E. (Mechanical) (Part - II) (Semester - VI) (Revised)
(New) Examination, April - 2016
METROLOGY AND QUALITY CONTROL
Sub. Code : 66839

Day and Date : Thursday, 21-04-2016   Total Marks : 100
Time : 3.00 p.m. to 6.00 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) Solve any two of the following: **[18]**

a)   Distinguish between line standard and end standard of measurement.

b)   Explain the neat sketch "hole basis system" and "shaft basis system". Which system is preferably used? Why?

c)   State what type of fit will be confirmed for following pairs as hole basis system and Give its application.

     i) $H_8 - f_8$

     ii) $H_{11} - C_{11}$

     iii) $H_6 - t_5$

     iv) $H_8 - r_7$

Q2) Solve any two of the following: **[16]**

a)   Explain with neat sketch i) Clinometer ii) Spirit level.

b)   What is difference between autocollimator and angle dekkor? Enumerate different applications of angle dekkor.

c)   State advantage and disadvantages of mechanical comparator over optical comparator.

Q3) Solve any two of the following: [16]

a) Explain principle of interferometry. How it is used for the measurement of flatness of a surface.

b) Explain the principle of auto-collimator and use for straightness measurement. How the straightness of a vertical surface can be checked with this method?

c) Define surface roughness and explain CLA method for measurement of surface roughness.

Q4) Solve any two of the following: [16]

a) State the composite error in spur gear and with neat sketch explain the working of Parkinson gear testing machine.

b) Derive an expression for measuring constant chord with gear tooth vernier caliper.

c) Explain the construction, working and application of screw thread micrometer.

Q5) Solve any two of the following: [16]

a) What is quality assurance? Discuss the stages of quality assurance.

b) Explain the concept of balance between cost and quality and value of quality.

c) What are quality specifications? Specifications cover how many areas. Illustrate with a suitable example.

Q6) Solve any two of the following: [18]

a) List various control charts with their applications and briefly explain any two from them.

b) Discuss the conflicting interest of producer and consumer with operating characteristics curve.

c) In a capability study of a lathe used in turning a shaft to a diameter of 23.75 ± 0.1 mm a sample of 30 consecutive pieces was taken each day for 5 days. The diameters of these shafts are as given below. Construct the $\bar{X}$ and R chart and Comment on the process. (For sample size of 6 take $A_2 = 0.48$, $D_4 = 2$, $D_3 = 0$, $d_2 = 2.534$).

1st day	2nd day	3rd day	4th day	5th day
23.77	23.76	23.77	23.79	23.78
23.80	23.80	23.78	23.76	23.76
23.78	23.77	23.77	23.79	23.73
23.73	23.72	23.75	23.74	23.76
23.76	23.78	23.80	23.82	23.74
23.75	23.78	23.74	23.76	23.80

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T.E. (Mechanical) (Part - III) (Semester - VI) (Revised) Examination, April - 2016

INTERNAL COMBUSTION ENGINES

Sub. Code : 48870 66841

Day and Date : Monday, 25 - 04 - 2016.

Time : 03.00 p.m. to 06.00 p.m.

Total Marks : 100

Instructions : 1) Attempt all the questions.

2) Neat diagrams must be drawn wherever necessary.

3) Make suitable assumptions if necessary and clearly mention them.

Q1) Solve any two from the following.

a) Define the following :   [8]
   i)   Cubic Capacity   ii)   Stroke

   iii) Cetane number   iv)   A/F ratio

b) Write classification of I.C. engines and explain each type, giving examples.   [8]

c) Explain with neat sketch the port timing diagram for 2 stroke SI engines.   [8]

Q2) Solve any two from the following.

a) A simple jet carburetor is required to supply 5 kg of air and 0.5 kg of fuel per minute. The fuel specific gravity is 0.75. The air is initially at 1 bar and 300 K. Calculate the throat diameter of the choke for a flow velocity of 100 m/s. Velocity coefficient is 0.8. If the pressure drop across the fuel metering orifice is 0.80 of that of the choke, calculate orifice diameter assuming, $C_{df} = 0.60$ and $\gamma = 1.4$ [8]

b) Describe multi point fuel injection system (MPFI) for petrol engine with its merits and demerits over carburetion system.   [8]

c) Explain with neat sketch CRDi system in details.   [8]

Q3) Solve any two from the following.

 a) Explain the effects of various engine variables on detonation. [8

 b) Explain Octane number and HUCR in details. [8

 c) Write in details the various mixture requirements of S.I. engine to be fulfilled by carburetor. [8

Q4) Solve any two from the following.

 a) Explain the types of combustion chambers for SI engines and highlight its requirements. [8]

 b) Explain the stages of combustion in CI engines with $P - \theta$ diagram.[8]

 c) Which are the different methods of generating air swirl in CI engine combustion chamber? Explain any one of them with figure. [8]

Q5) Solve any two from the following.

 a) What do you mean by heat balance sheet of I.C. engine? Explain how engine heat balance sheet is prepared. [8]

 b) The following observations were recorded during a trial of a four stroke, single-cylinder oil engine. Duration of trial is 30 min; oil consumption is 4 liters; calorific value of the oil is 43 MJ/kg; specific gravity of fuel = 0.8; average area of indicator diagram = 8.5 cm²; Length of the indicator diagram = 8.5 cm; spring constant = 5.5 bar/cm; brake load = 150 kg; spring balance reading = 20 kg; effective brake wheel diameter = 1.5 m; speed = 200 rpm; cylinder diameter = 30 cm; stroke = 45 cm; jacket cooling water = 10 kg/min; temperature rise is 36°C. Calculate [10]

 i) indicated power

 ii) brake power

 iii) mechanical efficiency

 iv) brake specific fuel consumption in kg/KWhr and

 v) indicated thermal efficiency

 c) List different methods of measurement of frictional power of engine. Explain anyone method. [8]

Q6) Write a short notes on any three

   a) Emissions from SI engines

   b) Catalytic convertors

   c) EGR

   d) Bio-fuels and its suitability for engine

   e) Selection of suitable I.C. engine for a generator set and a cargo ship

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Seat No.

T.E. (Mechanical) (Part - III) (Semester - VI) (Revised) Examination, May - 2015

RENEWABLE ENERGY ENGINEERING

Sub. Code : 45569

Day and Date : Friday, 08 - 05 - 2015   Total Marks : 100

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

Instructions :   1)   Solve 'any three' questions from each section.

                   2)   Figures to the 'right' indicate 'full' marks.

                   3)   Assume suitable data if necessary.

SECTION - I

Q1) a)   What are the potential renewable energy sources and state their importance.   [8]

b)   What are the distributed & dispersed energy systems? Describe the characteristics of both of them.   [8]

Q2) a)   Describe with neat sketch the method for measurement of global & diffuse radiation .   [8]

b)   Differentiate focussing type collectors with flat plate collectors.   [8]

Q3) a)   What do you mean by monocrystalline & poly crystalline PV cell? What is maximum power point tracking?   [8]

b)   Explain '$H_2 - O_2$' fuel cell with the help of a neat sketch. What are the limitations of fuel cells?   [8]

Q4) Write short notes on (Any Three):   [18]

a)   Types of solar energy storage

b)   Photo-cell materials.

c)   Solar cooking

d)   Testing of solar collectors.

SECTION - II

Q5) a) Sketch the diagram of a VAWT, and explain the functions of it's main components. **[6]**

b) Explain lift and drag forces acting on wind turbine blades. **[5]**

c) Comment on the environmental impacts of wind energy. **[5]**

Q6) a) Explain liquid dominated low temperature-binary fluid geothermal system. List advantages and disadvantages of geothermal energy. **[8]**

b) Explain the working principle of OTEC plant. **[4]**

c) Discuss the working of double basin type tidal power plant. **[6]**

Q7) a) Discuss the factors which affect the biogas production in details. **[8]**

b) What are different biomass energy resources. **[8]**

Q8) a) Explain working of hybrid electric vehicle. **[6]**

b) Explain types of energy audit and factors reported in a detailed energy audit. **[10]**

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Seat
No.

T.E. (Part - III) (Mechanical) (Semester - VI) (Revised) Examination, December - 2015

RENEWABLE ENERGY ENGINEERING

Sub. Code : 45569

Day and Date : Wednesday, 02 - 12 - 2015   Total Marks : 100

Time : 02.30 p.m. to 05.30 p.m.

Instructions :   1)   Solve 'any three' questions from each section.

             2)   Figures to the night indicate full marks.

             3)   Assume suitable data if necessary.

SECTION - I

Q1) a)   What is the present status of India's production and reserves of commercial energy sources? Explain.   [8]

     b)   List & explain the limitations of various conventional & nonconventional sources of energy.   [8]

Q2) a)   Explain the following terms :   [8]

         i)   Solar azimuth angle

         ii)   Latitude angle,

         iii)   Hour angle &

         iv)   Declination angle

     b)   Give different types of solar collectors by drawing neat sketches.   [8]

Q3) a)   What is the operating principle of a PV cell? Explain with the help of a neat sketch.   [8]

     b)   Classify different types of fuel cells & Give performance characteristics. [8]

Q4) Write short notes on (any three) [18]

   a)   Solid oxide fuel cell

   b)   Solar ponds

   c)   Compound Parabolic Collector (CPC)

   d)   Solar tracking methods for concentrating collectors

SECTION - II

Q5) a)   Explain the status of wind power in India and explain important criteria for selection of site. [8]

   b)   Explain wind energy conversion systems (WECS) with general block diagram. [8]

Q6) a)   Explain with neat sketch liquid dominated geothermal system. [6]

   b)   What are the major applications of geothermal energy. [4]

   c)   Discuss the working principle of closed cycle OTEC plant with neat sketch. Discuss the advantages and disadvantages of OTEC system.[8]

Q7) a)   Discuss the classification of biogas plant. Explain batch type biogas plant. [8]

   b)   Explain solar-wind hybrid power plant with neat block diagram. Write their advantages. [8]

Q8) a)   Explain strategy for energy conservation. [6]

   b)   What do you understand by "Energy audit"? [6]

   c)   Explain "Energy Plantation". [6]

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Seat
No.

T.E. (Mechanical) (Part - III) (Semester - VI) (Revised) Examination,
December - 2015

INTERNAL COMBUSTION ENGINES

Sub. Code : 45570

Day and Date : Thursday, 03 - 12 - 2015   Total Marks : 100
Time : 02.30 p.m. to 05.30 p.m.

Instructions :   1)   Attempt any three questions from each section.

2)   Neat diagrams must be drawn wherever necessary.

3)   Make suitable assumptions if necessary and state it clearly.

SECTION - I

Q1) a)   Define the following :   [8]

    i)   Bore   ii)   Swept volume

    iii)   Thermal efficiency   iv)   Volumetric efficiency.

    b)   Explain the difference between the air standard cycle and actual cycle
        of an I C Engine.   [8]

Q2) a)   Define principal of simple carburetor and what are the limitations of
        simple Carburetor?   [8]

    b)   A single jet carburetor is to supply 6 kg of air per minute and 0.44 kg per
        minute of petrol of specific gravity 0.74. The air is initially at 1 bar and
        27°C. Assuming an isentropic coefficient of 1.35 for air, Determine :   [8]

        i)   The diameter of venture if air speed is 90 m/s. and the velocity
            coefficient for venture is 0.85,

        ii)   The diameter of jet if pressure drop at the jet is 0.8 times the
            pressure drop at the venturi, and Cd for jet = 0.06.

Q3) a) Describe the Multi point Fuel injection system for petrol engines. [8]

b) State the merits and demerits of multiple orifice nozzle used for CI engines. [8]

Q4) Short notes on (any three) : [18]

a) Selection of engines for power generation.

b) Governing of CI engines.

c) Valve timing diagram for petrol engine.

d) Effect of supercharging on engine performance.

e) Electronic fuel injection.

SECTION - II

Q5) a) What are the functions of nozzle? With neat sketches explain the various types of nozzles. [10]

b) Determine the diameter of a fuel orifice for a four stroke engine developing 20 kw per cylinder at 2000 rpm using 0.18 kg/kw.hr fuel of 0.870 specific gravity. The duration of injection is 30° crank travel. The fuel injection pressure is 140 bar and combustion pressure is 50 bar. The velocity co-efficient for nozzle is 0.85. [6]

Q6) a) Explain the combustion stages in C.I. engine with the help of P-θ curve. [8]

b) Which are the different method of generating air swirl in. C.I. engine combustion chamber? Explain any one of them with fig. [8]

Q7) a) How will you select I.C. Engine for power generation. [6]

b) During trial on single cylinder single acting oil engine working on 4 stroke cycle following observations were made. [10]

i) Duration of trial = 1 hour

ii) Fuel used = 8 kg

iii) C.V. of fuel = 44 MJ / kg

iv) Indicated mean effective pressure = 6.86 bar

v) Total revolution = 1.2624

vi) Net brake load = 1.6 kN

vii) Drum diameter = 1.8 m

viii) Cooling water = 600 kg

ix) Inlet tempt. of cooling water = 16°C.

x) Outlet tempt. of cooling water = 60.5°C

xi) Bore = 30 cm

xii) Stroke = 45 cm

Determine the thermal efficiency on I.P & B.P basis and draw heat balance sheet.

Q8) Write short notes on (any three) [18]

a) Thermal catalytic converters.

b) Alternative fuels for S.I. engines.

c) I.S. standard code 10000 to 10004.

d) EGR for emission control.

e) Standard pollution norms.

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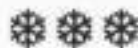
T.E. (Mech.) (Semester - VI) Examination, December - 2015
COMPUTER INTEGRATED MANUFACTURING (New Course)
Sub. Code : 45572

Day and Date : Saturday, 05 - 12 - 2015   Total Marks : 100
Time : 02.30 p.m to 05.30 p.m.

Instructions : 1)   Figure to the right indicates full marks to the question.
           2)   Answer three questions from each section.
           3)   Draw a neat - labeled block diagram whenever necessary.
           4)   Assume, if necessary, suitable data and state clearly.
           5)   Answers to the two sections must be written in one answer book indicating clearly question no. and section no.

SECTION - I

Q1) a) Sketch computer integrated manufacturing system architecture. What are the benefits, limitations and obstacles in CIM implementation? [8]

    b) Explain relevance of group technology in CIM. State benefits and limitations of GT.   [8]

Q2) a) Describe the structure and various activities of retrieval type Computer Aided Process Planning (CAAP) system.   [8]

    b) Explain aggregate planning and master production schedule.   [8]

Q3) a) Explain computerized inventory control system and the benefits derived from it.   [8]

    b) Explain structure of MRP-II and different databases used in it.   [8]

Q4) Write short notes on :   [18]
    a) OPTIZ - classification and coding system.
    b) Factory data collection system.
    c) Role of CAD/CAM in CIM.
    d) Shop floor control.
    e) MRP-I.

SECTION - II

Q5) a) State the working principle of CMM and explain the different probes used. [8]

b) What are AGV'S? Explain working and give any two applications of AGV. [8]

Q6) a) Explain Computer Aided Quality Control (CAQC) and compare conventional and Computer Aided Quality Control Systems. [8]

b) What is DBMS? Discuss the scope of DBMS in CIMS. [8]

Q7) a) Discuss in brief the phases of CIMS implementation. [8]

b) Explain networking concepts and its importance in CIM. [8]

Q8) Write short notes on (any three) : [18]

a) AS/RS control.

b) ISO-OSI reference model.

c) LAN (Local Area Network).

d) Contact and non-contact inspection systems.

e) Configurations of Robot.

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T.E. (Mechanical) (Part - II) (Semester - VI) (New)
Examination, December - 2015
INDUSTRIAL FLUID POWER
Sub. Code : 45571

Day and Date : Friday, 04-12-2015   Total Marks : 100
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) Answer any three questions from each Section.
                2) Figures to right indicate full marks.
                3) Assume suitable data if necessary and state if clearly.
                4) Draw neat diagrams/sketches wherever necessary.

SECTION - I

Q1) a) Classify hydraulic accumulators. Explain any one with its advantages and limitations.   [8]

    b) Explain advantages, limitations and applications of fluid power.   [8]

Q2) a) Draw ISO symbols for following hydraulic circuit components: [8]

        i)   Check valve.

        ii)   Double acting cylinder with adjustable cushion at both ends.

        iii) Cooler.

        iv)   4/3 solenoid operated DC valve.

    b) Explain desirable properties of a good hydraulic fluid.   [8]

Q3) a) Classify and explain the need of pressure control valves. Explain any one in detail.   [8]

    b) Explain with neat sketch Meter out circuit with its advantages, limitations and applications.   [8]

P.T.O.

Q4) Write short notes on (Any three) [18]

    a)   Sources of contamination.

    b)   Hydraulic pumps.

    c)   Hydraulic seals.

    d)   Effect of pressure and temperature on hydraulic fluid.

    e)   Fluid conducting elements in hydraulic system.

SECTION - II

Q5) a)   Draw a neat block diagram of generalized pneumatic system with ISO symbols of various components and explain its working. [8]

    b)   Explain the difference between hydraulic and pneumatic system. [8]

Q6) a)   Classify air compressors. Explain any one type in detail. [8]

    b)   Explain FRL unit with neat sketch and its need. [8]

Q7) a)   What is fluidics? Explain with neat sketches any two fluidic sensors. [8]

    b)   Explain various valve actuation mechanisms in pneumatic systems. [8]

Q8) Write short notes on (Any three) [18]

    a)   Industrial applications of pneumatic systems.

    b)   Pneumatic servo system.

    c)   Maintenance and trouble shooting of pneumatic systems.

    d)   Speed control circuits in pneumatics.

    e)   Time delay valve.

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T.E.(Mechanical) (Part - II) (Semester -VI)
Examination, December - 2015
MACHINE DESIGN - II
Sub. Code: 45568

Day and Date : Tuesday, 01 - 12- 2015   Total Marks : 100
Time :2.30 p.m. to 5.30 p.m.

Instructions : 1) Answer any three questions from section -I and three questions from
                    section - II.
                2) Assume suitable data/assumption wherever necessary and mention
                    them clearly.
                3) Use of non-programmable calculator is permitted.
                4) Figures to the right indicate full marks.

SECTION - I

Q1) a) Explain the following terms in relation with the design of components
            subjected to fluctuating loads.   [6]

   i)   Fatigue failure

   ii) Endurance limit

   iii) Notch sensitivity

   b) A machine component is subjected to two-dimensional stresses. The
       tensile stress in the X direction varies from 40 to 100 N/mm² while the
       tensile stress in the Y direction varies from 10 to 80 N/mm². The frequency
       of variation of these stresses is equal. The corrected endurance limit of
       the component is 270 N/mm². The ultimate tensile strength of the material
       of the component is 660 N/mm², determine the factor of safety used by
       the designer.   [10]

Q2) a) Explain 'Stiffening factor' in design of plastics. What are the various
            ways of stiffening in plastics?   [8]

   b) Explain various tribological consideration used in machine tool design. [8]

P.T.O.

Q3) a) Explain the failure of antifriction bearings with causes and suggest the remedies for the same. [8]

b) A single - row deep groove ball bearing number 6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. Use data from table no 1 & 2. [8]

Table No. 1

Principal Dimensions (mm)			Basic Load Rating (N)		Designation
d	D	B	C	C_0	
15	24	5	1560	815	61802
	32	9	5590	2500	6002
	35	11	7800	3550	6202
	42	13	11400	5400	6302

Table No. 2

$\left(\dfrac{F_a}{C_0}\right)$	$\left(\dfrac{F_a}{F_r}\right) \le e$		$\left(\dfrac{F_a}{F_r}\right) > e$		e
	X	Y	X	Y	
0.025	1	0	0.56	2.0	0.22
0.040	1	0	0.56	1.8	0.24
0.070	1	0	0.56	1.6	0.27
0.130	1	0	0.56	1.4	0.31
0.250	1	0	0.56	1.2	0.37
0.500	1	0	0.56	1.0	0.44

Q4) a) Explain with neat sketches the basic modes of lubrication in case of sliding contact bearings. [8]

b) The following data is given for a 360° hydrodynamic bearing:

length to diameter ratio   = 1

journal speed   = 1350 r.p.m.

journal diameter   = 100 mm

diametral clearance   = 100 μm

external load   = 9 kN

The value of minimum film thickness variable is 0.3. Find the viscosity of oil that need to be used. Refer table no.3.   [10]

Table No. 3

$\left(\frac{1}{d}\right)$	ε	$\left(\frac{h_o}{c}\right)$	S	ϕ	$\left(\frac{r}{c}\right)f$	$\left(\frac{Q}{rcn_s l}\right)$	$\left(\frac{Q_s}{Q}\right)$	$\left(\frac{p}{p_{max}}\right)$
1	0	1.0	∞	(85)	∞	π	0	-
	0.1	0.9	1.33	79.5	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	74.02	12.8	3.59	0.280	0.529
	0.4	0.6	0.264	63.10	5.79	3.99	0.497	0.484
	0.6	0.4	0.121	50.58	3.22	4.33	0.680	0.415
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	26.45	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	15.47	0.514	4.82	0.973	0.152
	1.0	0	0	0	0	0	1.0	0

SECTION - II

Q5) a)   Explain design consideration of rim, spokes (arm) & hub of gears.   [6]

b)   Design a pair of spur gears with 20° full depth involute teeth consist of 20 teeth pinion meshing with 50 teeth gear. The pinion shaft is connected to 22.5 KW, 1450 rpm electric motor. The starting torque of motor is 150% of rated torque. The material for the pinion is plain carbon steel Fe410 ($S_{ut} = 410N/mm^2$) and gear is made of grey cast iron FG200 ($S_{ut}=200N/mm^2$). The factor of safety is 1.5. Design the gears based on Lewis equation and using the velocity factor to account for the dynamic load. Use Y for 20 teeth = 0.32 and Y for 50 teeth = 0.408.   [10]

Q6) a) Explain with neat sketch the concept of formative number of teeth in helical gear. [6]

b) Calculate the power transmitting capacity of a pair of parallel helical gear consisting of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20°, while the helix angle is 25°. The face width is 40 mm and normal module is 4 mm. Both the gears are made of steel with S_{ut}=600N/mm² and heat treated to a surface hardness of 300BHN. Take C_s = 1.5 and factor of safety as 2. Assume that the velocity factor to accounts for the dynamic load. [10]

Lewis form factor various no. of teeth are in table below.

No.of teeth	20	21	22	23	24	25	26	27
Y	0.32	0.326	0.33	0.333	0.337	0.34	0.344	0.348

Q7) a) Explain with neat sketch force analysis of bevel gear. [6]

b) Design a pair of bevel gears with 20° full depth involute teeth consists of a 20 teeth pinion meshing with a 30 teeth gear. The module is 4 mm and face width is 20 mm. The pinion and gear are made of 50C8 (S_{ut}=750 N/mm²). The gears are lapped and ground (class-3) and heat treated to surface hardness of 400 BHN. The pinion rotates at 500 rpm and receives 2.5 KW power from the electric motor. The starting torque of motor is 150% of rated torque. Determine the factor of safety against bending and pitting failure. Use Bucking approach for dynamic load. Assume deformation factor is 11400N/mm² and tooth error is 0.0125 mm. [12]

No.of teeth	20	21	22	23	24	25	26	27
Y	0.32	0.326	0.33	0.333	0.337	0.34	0.344	0.348

Q8) a) Explain the strength rating of worm and worm wheel. [6]

b) A pair of worm and worm wheel is designated as 2/41/10/8. The input worm shaft speed is 1450 rpm. The wrom wheel is made of centrifugally cast phosphor bronze and worm is made of case hardened alloysteel. Determine the power transmitting capacity based on beam strength. Assume for case hardened alloy steel, Sb1-33.11, for centrifugally cast phosphor bronze, Sb2-6.4, Xb1-0.24 for n1=1450 rpm and Xb2 -0.44 for n2 = 20.5 rpm. [10]

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Seat No.

T.E. (Mechanical) (Semester - VI) Examination, December - 2015
INDUSTRIAL MANAGEMENT AND OPERATIONS RESEARCH
Sub. Code : 45573

Day and Date : Monday, 7 - 12 - 2015   Total Marks : 100

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

Instructions :   1)   Attempt any three questions each from section I & II.
2)   Use of non-programmable calculator is allowed.
3)   Figures to the right indicate full marks.
4)   Make suitable assumptions for missing data and state them clearly.

SECTION - I

Q1) a)   Explain the following concepts with example for each: (Any Two)   [8]
i)   Authority and responsibility
ii)   Span of control
iii)   Departmentation
iv)   Delegation

b)   A company wants to hire middle level experienced software professionals for its overseas project. What are the potential sources of manpower? Describe the steps in recruitment procedure of these middle level managers.   [10]

Q2) a)   Explain in brief 4P's of marketing. Distinguish between marketing and selling.   [8]

b)   Explain the role of materials management in a company. Briefly list the scope and objectives of materials management.   [8]

Q3) a)   What are the traits of a good leader? List the various leadership styles and explain any one.   [8]

b)   A purchase department of company purchase various items required for its production from various suppliers. Explain the steps in purchasing procedure. How does the company measure the performance of purchasing department?   [8]

Q4) a) An engineering graduate wants to start his own machine shop to process machining components from various industries. How he should establish the feasibility for the project. Explain the steps how he should go about starting his own machine shop. What are the incentives available to him as a technical entrepreneur? [8]

b) Classify the problems of SSI units and recommend steps to these problems can be solved. [8]

SECTION - II

Q5) a) A company sells two different products A & B. The company makes a profit of Rs. 40 and Rs. 30 per unit respectively on the two products. The products are produced by a common production process and are sold in two different markets. The production process has a capacity of 30,000 man-hours. It takes 3 hours to produce a unit of product A and 1 hour to produce a unit of product B. The market has been surveyed and the company officials found out that the maximum units that can be sold for product A & B are 8,000 & 12,0000 respectively. Formulate the LPP and solve graphically. [8]

b) Solve the following linear programming problem by simplex method. [10]

Maximize $Z = 3x1 + 5x2 + 4x3$.

Subject to $2x_1 + 3x_2 \leq 8$

$2x_2 + 5x_3 \leq 10$

$3x_1 + 2x_2 + 4x_3 \leq 15$

$x_1, x_2, x_3, \geq 0$

Q6) a) Explain the following: (any two) [6]

i) Concept of quality

ii) Type of assignment models

iii) Phases of OR

-2-

b) The captain of a cricket team has to allot five middle batting position to five batsmen. The average runs scored by each batsman at each batsman at these positions are as follows.

Batting position

Batsman	I	II	III	IV	V
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

Find the assignment of batsmen to position which would give the maximum number of runs. [10]

Q7) a) Explain the following with respect to transportation model. (Any Two)[6]

   i) Basic feasible solution

   ii) Optimal solution

   iii) Degenerate basic feasible solution

   iv) Unbalanced transportation problem

b) Solve the following transportation problem. [10]

	A	B	C	D	E	supply
P	8	10	12	17	15·	200
Q	15	13	18	11	9	275
R	14	20	6	10	13	125
S	13	19	7	5	12	250
demand	125	175	100	125	150	

Q8) a) There are seven jobs, each of which must go through machines A, B and C in order ABC. Processing times are given below. Determine the sequence for five jobs that will minimize the elapsed time and also the idle time for all three machines. [8]

Job/m/c	1	2	3	4	5	6	7
A	12	6	5	11	5	7	6
B	3	4	1	5	2	3	4
C	7	8	9	4	7	3	3

b) A bread seller purchases bread packets everyday at Rs 23 per packet and sells them at Rs 25 the packets unsold at the end of the day are disposed off at Rs 22 the sales for the past 100 days is as follows.

Packets sold	10	11	12	13	14
No. Of days	10	20	40	20	10

Using the decision theory, find out how many packets should the bread seller purchase everyday to have maximum profit. [8]

■ ■ ■

Seat
No.

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 :   1)   All questions are compulsory.
   2)   Figures to the right indicate full marks.
   4)   Assume suitable data, if necessary.

Q1) Attempt any four from the following (5 marks each).   **[20]**

a) How far the components of scientific management as proposed by Taylor are relevant in Indian situation?

b) Compare different theories of motivation. Suggest suitable theory for motivating supervisory staff in manufacturing organization.

c) Discuss the advantages and limitations of external sources of recruitment.

d) What are the barriers in downward communication? How can these be made effective?

e) Suggest some guiding principles in designing an effective control system.

Q2) Attempt any two from the following (6 marks each).   **[12]**

a) Explain in brief various sources to obtain financial assistance for a small-scale industry.

b) Discuss about qualities need to be developed if you want to be a successful entrepreneur.

c) What are the possible reasons for accidents in heat treatment shop? Which preventive measures do you suggest to prevent those accidents?

P.T.O.

Q3) Write short notes on any three (6 marks each). [18]

  a) Market Segmentation

  b) Advertising

  c) Evaluation of Purchase Performance.

  d) Cost reduction

Q4) Attempt any three from the following (6 marks each) [18]

  a) What are the situations where OR techniques are applicable?

  b) Use Graphical Method to solve the following LPP

  Maximize $Z = 80x_1 + 120x_2$

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

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

  $$x_1 \geq 2$$

  $$x_2 \geq 3$$

  $$x_1, x_2 \geq 0$$

  c) A firm makes products of X & Y and has total production capacity of 9 tons per day. X a & 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.

  d) 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]

  a) How will you handle the following situation in transportation problem

  i) Unbalanced

  ii) Degeneracy

  iii) Loops in transportation problem.

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					
	To					Supply
	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

What will be your decision under the following approach.

i) Pessimistic criterion

ii) Optimistic criterion

iii) Regret criterion

iv) Laplace criterion

v) Hurwicz criterion with $a = 0.4$

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

i) Draw the network

ii) Determine the expected project completed time

iii) 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?

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Seat
No.

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]**

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]

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

Total Marks : 100

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]

a) Explain with suitable example ten point height method and center line average method.

b) Explain construction and working of Tomlinson surface meter.

c) Explain with neat sketch the checking of flatness by interferometry.

Q4) Attempt any two questions of the following [16]

a) Explain with the neat sketch construction and working of gear tooth vernier caliper.

b) Derive the expression for measurement of effective diameter of thread by using three wire method.

c) 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]

a) Differentiate

i) Quality control and Quality assurance

ii) Sampling inspection and 100% inspection.

b) What is cost of quality? Explain cost of failure, cost of appraisal and cost of prevention.

c) Explain with suitable example following quality control tools.

i) Histogram

ii) Pareto Diagram

Q6) Attempt any two questions of the following [18]

a) Explain with suitable example producer and consumer risk. Discuss instances for which one type of risk might be more important than other.

b) 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.

c) The following are the 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 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
X	10.2	12.1	10.8	10.5
R	1.1	1.3	0.9	0.8

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Seat	
No.	

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 :   1)   Figures to right indicate full marks to the question.

2)   Use of programmable calculator is allowed.

3)   Assume any data if necessary and state it clearly.

Q1) 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]

i)   Endurance Limit

ii)   Surface finish factor

iii)   Size factor

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

i) $\pm 600 \text{N/mm}^2$ for 5% of time

ii) $\pm 550 \text{N/mm}^2$ for 10% of time

iii) $\pm 400 \text{N/mm}^2$ for 85% of time

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

P.T.O.

Q2) 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

Q3) a) Explain the desirable properties of good bearing material. [6]

OR

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

i) Length to diameter ratio

ii) Unit Bearing Pressure

iii) 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:

i) The coefficient of friction

ii) Power lost in friction

iii) Minimum oil film thickness

iv) Flow requirement in lit/min.

v) Temperature rise

Refer following table:

l/d	$\in$	h_o/C	S	θ	(r/C)f	$Q/(rCn_s l)$	Q_s/Q
	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
1	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

Q4) a) State the various materials used for gear manufacturing. Specify their field of application. [8]

<center>OR</center>

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

i) The beam strength

ii) The wear strength

iii) 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.

Q5) 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}=600N/mm²). 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√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]**

Q6) 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. **[10]**
Determine:
i) The center distance
ii) The speed reduction
iii) The dimensions of the worm
iv) The dimensions of the worm wheel.

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T.E. (Mechanical) (Part - III) (Semester - VI) (Revised) Examination, November - 2019
INTERNAL COMBUSTION ENGINES
Sub. Code : 66841

Day and Date : Wednesday, 20 - 11 - 2019

Total Marks : 100

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

Instructions :   1)   Attempt all the questions.
2)   Make suitable assumptions if necessary and clearly mention them.
3)   Figures to right indicate full marks.

Q1) Solve any two from the following

a)   Explain the following terms   [8]

  i)   Combustion Chamber

  ii)   Engine Capacity

  iii)   Swept Volume

  iv)   Compression Ratio

b)   Explain the selection of I.C. Engine for agriculture, genset, passenger car, power generation.   [8]

c)   Draw and explain valve timing diagram for low speed petrol engine. [8]

Q2) Solve any two from the following

a)   What are the factors affecting carburetion? Explain the air fuel ratio mixture requirements for S.I. engine.   [8]

b)   A simple jet carburetor is required to supply 6 kg of air per minute and 0.45 kg of fuel of density 740 kg/m³. The air is initially at 1.013 bar and 27°C. Calculate the throat diameter of choke for a flow velocity of 92 m/s. Velocity coefficient is 0.8. If the pressure drop across the fuel metering orifice is 0.75 of that at the choke, calculate orifice diameter assuming Cd = 0.60.   [8]

c)   Explain electronic diesel injection system.   [8]

P.T.O.

Q3) Solve any two from the following

 a) Why flame speed is important? Explain the effect of engine variables on flame propagation. [8]

 b) Explain the phenomenon of detonation in S.I. engine. What are the effects of detonation? [8]

 c) How SI engine fuels are rated? What is HUCR? Explain in brief. [8]

Q4) Solve any two of the following:

 a) Compare diesel engine combustion with combustion in petrol engines.[8]

 b) Explain with figures different types of combustion chambers in CI Engines. [8]

 c) Explain difference between open & divided type combustion chambers. Which type gives smoothness of operation & Why? [8]

Q5) Solve the following:

 a) Explain different engine efficiencies. [8]

 b) During the trial of a single cylinder, four stroke oil engine, following results were obtained. [10]

Cylinder diameter	= 20cm	
Stroke	=40cm	Find the ip, bp &
Mean effective pressure	= 6 bar	draw upG heat
Torque	=407N.M	balance sheet for
Speed	=250rpm	the test in KJ/hr.
Oil consumption	= 4 kg/hr	
calorific value of fuel	= 43 MJ/kg	
Cooling water flow rate	= 4.5 kg/min	
Air used per kg of fuel	= 30kg	
Rise in cooling water temperature	= 45°C	
Temp. of exhaust gases	= 420°C	
Room temperature	= 20°C	
Mean specific heat of gas	= 1kJ/kg.k	
Specific heat of water	= 4.18 kJ/kg.k	

Q6) Write short note on any three: [18]

a) Alternative fuels for SI & CI engines.

b) Alcohol an alternative fuel.

c) EGR for emission control.

d) Supercharging.

e) Selection of I.C. Engine for Locomotive.

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Seat
No.

T.E. (Mechanical) (Revised) (Semester - VI) Examination, November - 2018
INDUSTRIAL MANAGEMENT & OPERATIONS RESEARCH
Sub. Code : 66837

Day and Date : Monday, 12 - 11 - 2018   Total Marks : 100
Time : 02.30 p.m. to 05.30 p.m.

Instructions: 1)   All questions are compulsory.
                  2)   Figures to the right indicate full marks.
                  3)   Assume suitable data, if necessary.
                  4)   All questions are to be solved on one answer book only.

Q1) Attempt any four (5 marks each)   [20]

a)   Explain in brief steps in planning manufacturing a component using sand casting process.

b)   A company wants to hire welders and lathe operators. What sources of recruitment would you recommend to it?

c)   Is the appraisal methods of employees of all cader is same? Discuss in brief any one such forma used for any of the category.

d)   State the barriers in Communication process and suggest suitable remedies for the same.

e)   Discuss, "Motivation is an unending process".

Q2) Attempt any two (6 marks each)   [12]

a)   Define an entrepreneur? State the qualities required to be a successful entrepreneur in manufacturing agricultural components.

b)   Write the steps involved in starting a Small Scale Industry.

c)   Explain the changes in the latest release of ISO9001:2015 compared to ISO9001:2008

Q3) Write short notes on any three (6 marks each) **[18]**

a) Market Segmentation

b) Salesmanship and its performance measurement criterions

c) Purchasing cycle

d) 5-R Principles of purchasing

e) Elements of Costs

Q4) Attempt any three (6 marks each) **[18]**

a) Discuss the various steps used in solving Operations Research problems

b) Use graphical method to solve the following.

Maximize $Z = 8X_1 + 6X_2$

Subjected to constraints,

$$7X_1 + 5X_2 \leq 35$$
$$3X_1 + 4X_2 \leq 24$$
$$2X_1 + 6X_2 \leq 18$$
$$X_1, X_2 \geq 0$$

c) A company deals with three products A, B They are to be processed in three departments X, Y Products A require 2 hours of department X, 3 hours of department Y and product B requires 3 hours and 4 hours of department X and Y respectively. The profit contribution of A and B Rs. 300 and Rs.500 respectively. In the coming planning period, 80 hours of department X and 150 hours of department Y are available for production Formulate LPP for maximization of the profit.

Suggest suitable method for the solution of LPP.

d) Use simplex to solve the following problem and obtain initial and second feasible solution (two simplex tables only)

Minimise $Z = 2X_1 + 2X_2 + 4X_3$

Subjected to constraints,

$$3X_1 + 2X_2 + 7X_3 \leq 5$$
$$2X_1 + 3X_2 + 5X_3 \leq 3$$
$$X_1, X_2, X_3 \geq 0$$

Q5) Attempt any two (7 marks each) [14]

a) Describe the computational procedure of the optimality test in a transportation problem.

b) The unit transportation cost along with capacity and requirements from a supplier to a cities is as given below

Supplier	City				Capacity
	1	2	3	4	
A	9	5	8	5	450
B	9	10	13	7	150
C	14	5	3	7	200
Requirements	250	160	190	200	

Obtain initial basic feasible solution by least cost method & VAM.

c) A batch of four jobs can be assigned to five different machines. The following table give setup time in minutes for each jobs on the following machines

Solve the assignment problem & estimate the setup time.

Job	Machine				
	A	B	C	D	E
1	62	78	50	120	82
2	71	84	61	73	59
3	87	92	100	71	81
4	48	64	87	77	80

Q6) Write short notes on any three (6 marks each) [18]

a) Explain the various quantitative methods that are useful for decision making under uncertainty.

b) The following matrix gives the payoff (in Rs.) of different strategies against events.

Strategies		Events	
	E_1	E_2	E_3
S_1	3000	1200	1500
S_2	2000	800	1000
S_3	2500	1000	1800

What will be your decision under the following approaches.
i) Optimistic Criterion
ii) Pessimistic Criterion
iii) Laplace Criterion
iv) Hurwicz Criterion ($\alpha = 0.6$)

c) Draw the project network for the following activities and determine critical path and project duration.

Activity	Preceding activity	Duration (days)
A	-	30
B	-	20
C	A,B	20
D	A,B	20
E	B	10
F	D,E	10
G	C,F	40
H	D,E	20
I	G,H	30

d) Determine optimal sequence, elapsed time and idle time of the following six jobs on the machine M1,M2 and M3 used in the same sequence to process these jobs.

Machines	Jobs					
	J1	J2	J3	J4	J5	J6
M1	3	5	7	7	6	2
M2	7	6	5	9	6	5
M3	1	2	4	3	3	2

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Seat No.

T.E. (Mechanical) (Part - III) (Semester - VI) (Revised) Examination, November-2018
INDUSTRIAL FLUID POWER
Sub. Code : 66838

Day and Date : Tuesday, 13 - 11 - 2018   Total Marks : 100

Time : 02.30 p.m. to 05.30 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data wherever necessary.

Q1) Attempt any TWO:

a) Explain the basic components of hydraulic system with neat layout. [7]

b) Draw ISO/JIC symbols of following components of fluid power systems.[7]

    i)   5/2 Double solenoid operated DCV

    ii)   Time delay valve

    iii) Muffler

    iv) Air motor

    v)   Pressure reducing valve

    vi) 3/2 roller operated spring return DCV

    vii) Gas charged accumulator

c) State the functions of hydraulic fluids. Explain service properties of hydraulic fluids. [7]

Q2) Attempt any THREE :

a) Explain the sources of contamination of hydraulic fluid. [6]

b) Explain construction and working of axial piston pump with neat sketch.[6]

c) Explain hydraulic power pack with neat sketch. [6]

d) Explain spring loaded accumulator. Also state its advantages and limitations. [6]

P.T.O

Q3) Attempt any THREE :

a) Explain the requirements of pressure, direction and flow control in fluid power system. [6]

b) Draw neat and labeled sketch of pilot operated pressure relief valve. [6]

c) Explain 4/2 DCV with neat sketch. [6]

d) Explain pressure compensated flow control valve with neat sketch. [6]

Q4) Attempt any THREE :

a) Explain basic structure of pneumatic system with symbolic representation. [6]

b) "Pneumatics is known as low cost automation" Comment on this statement with proper justification. [6]

c) Explain construction and working of time delay valve with neat sketch.[6]

d) Explain pressure regulator element of FRL unit with neat sketch. [6]

Q5) Attempt any THREE :

a) A hydraulic system consists of two double acting cylinders. The extension of second cylinder takes place only when extension of first has been completed. During return stroke, both the cylinders retract at once. Draw and explain the circuit for the same. [6]

b) Explain the rapid traverse and feed circuit used in hydraulic system. [6]

c) Draw and explain circuit to obtain automatic reciprocating motion of single rod double acting pneumatic cylinder. [6]

d) How the time delay in pneumatic circuit is obtained? Explain with circuit diagram. [6]

Q6) Attempt any TWO :

a) Explain hydraulic servo system for linear motion with neat sketch. [7]

b) Identify the causes of following troubles occurred in hydraulic system : [7]
   i) noisy pump operation
   ii) Overheating of hydraulic fluid

c) Define fluidics. Explain any three fluid logic gates. [7]

Seat
No.

T.E. (Mechanical) (Revised) (Semester - VI) Examination, November - 2018
METROLOGY AND QUALITY CONTROL
Sub. Code : 66839

Day and Date : Wednesday, 14 - 11 - 2018   Total Marks : 100
Time : 02.30 p.m. to 05.30 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)   Define the following terms :

        i)   Wear allowance

        ii)   Upper deviation

        iii)   Lower deviation

        iv)   Zero Line

    b)   Explain with neat sketch Plain plug gauge and Plain ring gauge.

    c)   Determine the tolerances on the hole and the shaft for a precision running fit designated by $\phi50$ H7/g6. Determine the minimum and maximum clearance. The dimensions $\phi50$ lies between the ranges 30-50mm. Fundamental deviation for H-hole = 0. The fundamental deviation of g shaft = $-2.5 \, D^{0.34}$. The standard tolerance given by i = $0.45 \sqrt[3]{D} + 0.001$ D (micron).

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

    a)   Explain with neat sketch

        i)   Attachments of bevel Protractor

        ii)   Addition and Subtraction of angle gauges

    b)   Discuss methods used for magnification in pneumatic comparators and construction, working of solex pneumatic gauge.

    c)   Explain with neat sketch working principle, advantage and limitations of Dial gauge indicator.

P.T.O.

Q3) Attempt any two questions of the following : [16]

   a) Explain construction, working and use of autocollimator for testing flatness of surface plate.

   b) Explain construction and working of Taylor-Hobson talysurf.

   c) Define the following terms of surface roughness
      i) The Lay
      ii) Roughness height
      iii) Roughness width
      iv) Roughness width cutoff

Q4) Attempt any two questions of the following : [16]

   a) Explain with the neat sketch construction and working of screw thread micrometer.

   b) Derive the expression for measurement of effective diameter of thread by using two wire method.

   c) Define the pitch of a screw thread and describe the use of pitch measuring machine with neat sketch.

Q5) Attempt any two questions of the following : [16]

   a) Enlist seven quality control tools. Explain any three of them.

   b) Discuss the factors that control quality of design and quality of conformance.

   c) Discuss the specification of quality and cost of quality.

Q6) Attempt any two questions of the following : [18]

   a) Explain importance of statistical method in quality control.

   b) Draw operating characteristic curve and explain any three terms on it.

   c) Construct X, R charts using the data in the table given below and comment on the behavior of the process. For sample size 4, values of the constant used are $D_4 = 2.28$, $D_3 = 0$ and $A_2 = 0.73$.

Sr. No.	Reading				R
1	3.2	3.3	3.3	3.3	0.1
2	3.3	3.2	3.3	3.2	0.1
3	3.2	3.2	3.1	3.2	0.1
4	3.3	3.1	3.2	3.3	0.2
5	3.1	3.3	3.3	3.3	0.2

▽ ▽ ▽ ▽

Seat
No.

T.E. (Mechanical Engg.) (Semester - VI) Examination,
November - 2018
MACHINE DESIGN - II
Sub. Code : 66840

Day and Date : Thursday, 15 - 11 - 2018   Total Marks : 100
Time : 02.30 p.m. to 05.30 p.m.

Instructions :   1)   All questions are compulsory.
                  2)   Draw neat sketches whenever necessary.
                  3)   Figures to the right indicate full marks.
                  4)   Make suitable assumptions if necessary and state it clearly.

Q1) a)   Define notch sensitivity. Explain its significance in design of components
            subjected to fluctuating loads.   [8]

                                    OR

            Explain the following terms in relation with design of component subjected
            to fluctuating loads:

            i)   Endurance limit

            ii)   Surface finish factor.

            iii) Size factor.

            iv)   Notch sensitivity.

        b) A work cycle of a mechanical component subjected to completely
            reversed bending stresses consist of the following three elements: [8]

            i)   ±350 N/mm^2 for 85% of time.

            ii)   ±400 N/mm^2 for 12% of time.

            iii) ±500 N/mm^2 for 3% of time.

            The material for the component is 50C4 (S_{ut} = 660 N/mm^2) and the
            corrected endurance limit of the component is 280 N/mm^2. Determine
            the life of the component.

Q2) a) Explain the role of friction, wear and lubrication in the design of bearings. [6]

OR

Explain significance of DFM and its effect on design quality.

b) A single row deep groove ball bearing No 6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. Use table 1 and 2 for data.

Table 1 :parameters for single row deep groove ball bearings. [10]

Principal Dimensions (mm)			Basic Load Ratings(N)		Designation
d	D	B	C	Co	
10	19	5	1480	630	61800
	26	8	4620	1960	6000
	30	9	5070	2240	6200
	35	11	8060	3750	6300
15	24	5	1560	815	61802
	32	9	5590	2500	6002
	35	11	7800	3550	6202
	42	13	11400	5400	6302
20	32	7	2700	1500	61804
	42	8	7020	3400	16404
	42	12	9360	4500	6004
	47	14	12700	6200	6204

Table 2: X and Y Factors

$\left(\dfrac{F_a}{C_o}\right)$	$\left(\dfrac{F_a}{F_r}\right) \le e$		$\left(\dfrac{F_a}{F_r}\right) > e$		e
	X	Y	X	Y	
0.025	1	0	0.56	2.0	0.22
0.040	1	0	0.56	1.8	0.24
0.070	1	0	0.56	1.6	0.27
0.130	1	0	0.56	1.4	0.31
0.250	1	0	0.56	1.2	0.37
0.500	1	0	0.56	1.0	0.44

Q3) a) Explain Raimondi and Boyd method relating performance of bearings to dimensionless parameters. [8]

OR

Describe basic theory of Hydrodynamic lubrication.

b) The following data is given for a 360° hydrodynamic bearing. [10]

Radial load = 30 kN

Journal diameter = 75 mm

Bearing length = 75 mm

Journal speed = 3600 rpm

Radial clearance = 0.15 mm

Inlet temperature = 40°C

The temperature - viscosity relationship is as follows.

T(°C)	40	41	42	43	44	45	46	47	48	49	50
z(cP)	52.5	50	47.5	45	43	41	39	37.5	36	34	33

Assume that the total heat produced in the bearing is carried out by the total oil flow. The specific gravity and specific heat of the lubricant are 0.86 and 1.76 kJ/kg°C respectively. Calculate the power lost in friction and the requirement of oil flow.

Use fig. for data.

Vd	ε	h_o/C	S	ϕ	$(r/C)f$	$Q/(rCn_s1)$
	0.4	0.6	0.264	63.10	5.79	3.99
	0.6	0.4	0.121	50.58	3.22	4.33
1	0.8	0.2	0.0446	36.24	1.70	4.62
	0.9	0.1	0.0188	26.45	1.05	4.74
	0.97	0.03	0.0047	15.47	0.514	4.82

Q4) a) Derive an expression for beam strength or Lewis equation of spur gear tooth. State the assumption made for deriving the same. [7]

OR

Explain the design procedure for the constructions of arms for spur gears.

b) a pair of spur gears with 20° full depth involute teeth consists of a 19 teeth pinion meshing with a 40 teeth gear. The pinion is mounted on a crankshaft of a 7.5 KW single cylinder diesel engine running at 1500 rpm. The driven shaft is connected to a two stage compressor. Both the gears are made of steel 40C8 (S_{ut} = 600N/mm²) The module and face width of gears are 4 mm and 40 mm respectively.

   i) Using the velocity factor to account for the dynamic load, determine the factor of safety.

   ii) If the factor of safety is 2 for pitting failure, recommend the surface hardness for the gear.

   iii) If the gears are machined to meet the specification of grade 8, determine the factor of safety for bending, using spott's equation. Take Cs = 1.5 and Y = 0.314 for 19 teeth. for grade 8, error e = 16+1.25 (m+0.25√d) in μm. [11]

Q5) a) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20° and the helix angle is 25°. The normal module is 4 mm and the face width is 40 mm. the pinion and the gear is made of steel 40C8 (S_{ut}=600N/mm²) and heat treated to a surface hardness of 300 BHN. The service factor and factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. Use Y for 26 teeth = 0.344 and Y for 27 teeth = 0.348 [10]

OR

A pair of straight tooth bevel gears is mounted on shafts, which are intersecting at right angles. The number of teeth on pinion and gear are 21 and 28 respectively. The pressure angle is 20°. The pinion shaft is connected to an electric motor developing 5 KW rated power at 1440

rpm. The service factor for the application is 1.5. The material for the pinion and gear is steel with an ultimate tensile strength of 600N/mm². The gears are heat treated to a surface hardness of 300 BHN. The module is 4 mm and face width is 20 mm. respectively. The axial thickness of gear blank is 15 mm. The gears are machined by hobbing process to confirm to grade 8.

For grade 8, Error e = 16+1.25(m+0.25√ d) in microns and Y for 26 teeth = 0.344, Y for 27 teeth = 0.348

Determine the factor of safety for bending and pitting.

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

Q6) a) Explain with neat sketches force analysis in Bevel gear. [6]

OR

discuss the thermal consideration in the design of worm and worm wheel drive.

b) Worm and worm wheel drive is designated as 2/41/10/8. The drive is used to obtain speed reduction of 20.5 from an input speed of 1450 rpm. Material for worm wheel is sand cast and chilled phosphor bronze while the worm is made of case hardened alloy steel. Determine the power transmitting capacity based on beam strength. Use following data: speed factor for strength of worm (Xb1)= 0.24, speed factor for strength of worm wheel (Xb2) = 0.44, Bending stress factor for worm (Sb1) = 33.11, Bending stress factor for worm wheel (Sb2)=6.4 [10]

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T.E. (Mechanical Engineering) (Semester -VI) (Revised) Examination,
November - 2018
INTERNAL COMBUSTION ENGINES
Sub. Code : 66841

Day and Date : Friday, 16- 11 - 2018   Total Marks : 100
Time : 02.30 p.m. to 05.30 p.m.

Instructions :   1)   All the questions are compulsory.
                2)   Figures to the right indicate full marks.
                3)   Use suitable data wherever required and state it clearly.
                4)   Use of scientific non-programmable calculator is allowed.

Q1) Solve any two of following.

   a)   Define the following: **[8]**

       i)   Cubic capacity   ii)   Stroke

       iii)   BSFC   iv)   Swept volume

   b)   Compare S.I. engine and C.I. engine. State application of I.C. engine. **[8]**

   c)   Draw and explain valve timing diagram for C.I. engine.   **[8]**

Q2) Solve any two of following.

   a)   Describe MPFI system for petrol engine with its merits and demerits. **[8]**

                                     OR

   a)   Derive equation for air fuel ratio for simple carburetor by neglecting effect of compressibility.   **[8]**

   b)   A four cylinder four stroke engine running at 60 rev/s has a carburetor venturi with a 3cm throat. Assuming the bore to be 10cm, volumetric efficiency of 75%, the density of air to be 1.15 and coefficient of air flow to be 0.75. Calculate the suction at the throat.   **[8]**

Q3) Solve the following:

   a)   What is ignition lag? Explain the effect of engine variables on ignition lag.
                                                     [8]

   b)   Explain the effects of various engine variables on detonation.   **[8]**

   c)   What the basic requirements for a good S.I. engine combustion chamber.
                                                     [8]

Q4) Solve any two of following:
    a)   Explain the stages of combustion in C.I. engine.   [8]
    b)   Which are the different methods of generating air swirl in C.I. engine combustion chamber? Explain any one of them with neat sketch.   [8]
    c)   What is knocking in C.I. engine? What are the different methods used to reduce knocking.   [8]

Q5) Solve the following:
    a)   What are the different methods to measure frictional power of I.C.engine? Explain any one method.   [8]

<p align="center">OR</p>

    a)   What do you mean by heat balance sheet of I.C. Engine? Explain how engine heat balance sheet is prepared.   [8]
    b)   A single cylinder 4 stroke engine gave the following results while running on full load.   [10]
        Cylinder diameter = 250mm
        Stroke length = 400mm
        Gross mean effective pressure = 7 bar
        Pumping mean effective pressure= 0.5 bar
        Engine speed = 250rpm
        Net load on the brake = 1080 N
        Effective diameter of brake = 1.5 m
        Fuel used per hour = 10 kg
        Calorific value of fuel = 44300 kJ/kg
        Calculate:
        i)   Indicated power   ii)   Brake power
        iii)   Mechanical efficiency   iv)   Indicated thermal efficiency

Q6) Write short note on any three: [18]
    a)   Advantages and Disadvantages of supercharging of diesel engine.
    b)   Hybrid vehicles
    c)   EGR technique
    d)   Pollution control and GHG gases
    e)   Emissions from S.I. engine

<p align="center">ⓘ ⓘ ⓘ</p>

T.E. (Mechanical) (Semester - VI) (Revised)
Examination, November - 2017
INDUSTRIAL FLUID POWER
Sub. Code: 66838

Day and Date :Thursday, 02 - 11 - 2017
Time :2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions : 1) All questions are compulsory.

2) Draw neat diagrams/sketches wherever necessary.

3) Figures to right indicates full marks.

Q1) Solve any two:

a) Explain in brief the basic requirements of a Pneumatic system.   [7]

b) Explain the important properties of hydraulic fluids.   [7]

c) Draw the symbols and explain the function of the following elements:[7]

i) F.R.L unit

ii) Four way, three position-open center solenoid operated D.C valve.

iii) Weight loaded Accumulator.

iv) time delay valve.

Q2) Solve any three:

a) Explain the working of swash plate type axial piston pump with neat sketch.

[6]

b) Explain the function of cushioning in cylinders with neat sketch. [6]

c) Explain fluid conditioning and also explain with neat symbols types of reservoirs. [6]

d) Classify intensifiers and explain any one of them. [6]

Q3) Solve any three:

a) Draw a schematic of 4/2 pilot operated DCV and briefly explain its function. [6]

b) Draw schematically a sequence valve and explain its function. [6]

c) Explain the working of pressure compensated flow control valve with neat sketch. [6]

d) Explain use of any two center positions of D.C valves in hydraulic circuits. [6]

Q4) Solve any three:

a) Explain with neat sketch working of screw compressor used in pneumatic systems. [6]

b) Explain schematically different piping layouts in Pneumatic systems. [6]

c) Explain with the help of neat sketch the construction and working of air motor. [6]

d) Explain the working of 5/2 Direction control valve with a neat sketch. [6]

Q5) Solve any Three.

a) A vehicle is raised and held for about five hours and is to be descended slowly without any jerks, suggest and draw a suitable hydraulic circuit for the same. [6]

b) Explain the speed control circuit for an air motor. [6]

c) With the aid of circuit diagram explain the use of shuttle valve in pneumatic circuit. [6]

d) Explain with circuit diagram travel dependent sequencing mechanism in hydraulic system. [6]

Q6) Write short notes on: (Solve any two)

a) Pneumatic servo system. [7]

b) Safety precautions in handling hydraulic systems. [7]

c) Fluidics. [7]

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T.E. (Mechanical) (Part-III) (Semester - VI) (Revised) Examination, November - 2017
METROLOGY AND QUALITY CONTROL
Sub. Code :66839

Day and Date : Friday , 03 - 11 - 2017   **Total Marks : 100**
Time : 2.30 p.m. to 5.30 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) Solve any two of the following   **[18]**

a)   What is the limit gauges. Explain the 'Taylor's principle for design of 'limit gauges'

b)   Explain the following terms with neat sketch.

   i)   Unilateral tolerance

   ii)   Bilateral tolerance

   iii) Upper deviation

   iv)   Lower deviation

c)   Calculate the limits of the following 25 H7 d8 designated fit, identify it and draw it graphically, the standard tolerance is given by

   $i = 0.45D^{\frac{1}{3}} + 0.001D$

   i)   25 lies between steps of 18-30mm

   ii)   Fundamental deviation of d shaft=$-16D^{0.44}$

   iii) for grade IT7 tolerance = 16i and for IT8 tolerance=25i

   iv)   Fundamental deviation of H-hole=0

P.T.O.

Q2 Solve any two of the following   [16]

a)   Compare mechanical comparator with optical comparator with the help of neat sketches.

b)   Explain the use of sine bar for measuring an angle with the help of neat sketch and state its limitations.

c)   Explain construction, working and limitations of sigma comparator.

Q3) Solve any two of the following   [16]

a)   Define straightness and flatness. Briefly explain how straightness and flatness is measured and specified.

b)   Explain principle and working of Tomlinson's surface meter with neat sketch.

c)   Define surface texture, Lay and explain ten point average method for surface finish measurement.

Q4) Solve any two of the following   [16]

a)   Define major diameter, effective diameter and enumerate various errors in screw thread.

b)   Derive an expression for effective diameter measurement by 2-Wire method for external threads.

c)   Describe the gear tooth vernier caliper and explain its use for checking tooth thickness.

Q5) Solve any two of the following   [16]

a)   Differentiate between quality control and quality assurance.

b)   What is cost of quality? Explain cost of failure, cost of appraisal and cost of prevention.

c)   Discuss the factors that control, quality of design and quality of conformance.

Q6) Solve any two of the following [18]

a) State the advantages, applications of control charts and sketch different patterns of control charts

b) Discuss following acceptance sampling terms

   i) Average out going quality

   ii) Average out going quality level

   iii) Accepted quality level

c) A machine is working to a specification 80.75 ± 0.1 mm a study of 32 consecutive pieces shows the following measurements. Construct the $\overline{X}$ and R chart and calculate process capability (For sample size of 8 take $A_2 = 0.37$, $D_4 = 1.86$, $D_3 = 0.14$, $d_2 = 2.847$)

1st day	2nd day	3rd day	4th day
80.74	80.76	80.77	80.73
80.73	80.76	80.72	80.75
80.72	80.75	80.77	80.81
80.74	80.73	80.71	80.77
80.74	80.75	80.73	80.74
80.76	80.75	80.74	80.74
80.78	80.77	80.76	80.80
80.78	80.77	80.80	80.81

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Seat
No.

T.E. (Mechanical Engg.) (Part - III) (Semester-VI)
Examination, November - 2017
MACHINE DESIGN - II
Sub. Code : 66840

Day and Date : Monday, 06-11-2017   Total Marks : 100
Time : 2.30 p.m. to 5.30 p.m.

Instructions :   1)   All questions are compulsory.
                 2)   Draw neat sketches whenever necessary.
                 3)   Figures to the right indicate full marks.
                 4)   Make suitable assumptions if necessary and state it clearly.

SECTION-I

Q1) a) Define stress concentration. What are causes and remedies over stress
        concentration?   [8]

OR

a) Explain the following terms in relation with design of component subjected
    to fluctuating loads:

    i)   Endurance limit

    ii)   Surface finish factor

    iii) Size factor

    iv)   Notch sensitivity

b) A work cycle of a mechanical component subjected to completely
    reversed bending stresses consist of the following three elements: [8]

    i) ± 350 N/mm^2 for 85% of time

    ii) ± 400 N/mm^2 for 12% of time

    iii) ± 500 N/mm^2 for 3% of time

    The material for the component is 50C4 ($S_{ut} = 660$ N/mm^2) and the
    corrected endurance limit of the component is 280 N/mm^2. Determine
    the life of the component.

Q2) a) Explain the following terms in connection with roller bearing. **[8]**

   i) Static load capacity

   ii) Dynamic load capacity

   iii) Equivalent load capacity

   iv) Load - life relationship

<div align="center">OR</div>

a) Differentiate between static and dynamic capacity of the ball bearing. What is their significance in the selection of the bearings?

b) A deep-groove ball bearing having bore diameter of 60 mm and rotating at 1440 r.p.m. is subjected to radial force of 2500N and an axial force of 1200 N. The radial and thrust factors are 0.56 and 2.0 respectively. The load factor is 1.2. The expected rating life is 25,000 hrs. Calculate the required dynamic load capacity and select the bearing from manufacturer's catalogue given below in table no. 1. **[8]**

<div align="center">Table no.1</div>

	Principal Dimensions			Basic Capacity	
Bearing No.	Bore Dia 'd' mm	Outside Dia 'D' mm	Width 'B' mm	Static 'Co' kN	Dynamic 'C' kN
6012	60	95	18	23.20	29.60
6212	60	110	22	32.50	47.50
6312	60	130	31	52.00	81.90
6412	60	150	35	69.50	108.00

Q3) a) Explain the following terms in relation to sliding contact bearings, **[8]**

   i) Length to diameter ratio

   ii) Unit bearing pressure

   iii) Radial Clearance

   iv) Minimum film thickness

<div align="center">OR</div>

a) With neat sketches, describe construction and working principles of hydrodynamic bearings.

b) The following data is given for a 360° hydrodynamic bearing. **[10]**

Radial load = 3.2kN

Journal speed = 1490 rpm

Journal diameter = 50 mm

Bearing length = 50 mm

Radial clearance =0.05 mm

Viscosity of lubricant = 25 cp

Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate

i) Coefficient of friction

ii) Power lost in friction

iii) Minimum oil film thickness

iv) Flow requirement in litres/min

v) Temperature rise

Refer following data table:

l/d	ε	h_0/C	S	φ	(r/C)f	$Q/(rCn_sl)$
1	0.4	0.6	0.264	63.10	5.79	3.99
	0.6	0.4	0.121	50.58	3.22	4.33
	0.8	0.2	0.0446	36.24	1.70	4.62
	0.9	0.1	0.0188	26.45	1.05	4.74
	0.97	0.03	0.0047	15.47	0.514	4.82

SECTION - II

Q4) a) Explain different types of gear tooth failure. **[8]**

OR

a) Explain the force analysis in the design of spur gears.

b) It is required to design a pair of spur gears with $20°$ full-depth involute teeth consisting of a 20-teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 22.5 kW, 1450 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque. The material of the pinion is plain carbon steel Fe410 ($S_{ut} = 410$ N/mm^2), while the gear is made of grey cast iron FG 200 ($S_{ut} = 200$ n/mm^2). The factor of safety is 1.5. Design the gears based on the Lewis equation and using velocity factor to account for the dynamic load. Lewis form factors for 20 and 50 teeth are 0.32 and 0.408 respectively. Assume pitch line velocity as 5 m/s. Recommended series of module: 7 or 9. [8]

Q5) a) Derive expression for wear strength of helical gears. [8]

OR

a) Explain with neat sketch the concept of virtual number of teeth and its significance in the design of helical gear.

b) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 40 teeth gear. The helix angle is $25°$ and the normal pressure angle is $20°$. The normal module is 3mm. Calculate [10]
   i) The transverse module
   ii) The transverse pressure angle
   iii) The axial pitch
   iv) The pitch circle diameters of the pinion and the gear
   v) The centre distance and
   vi) The addendum and dedendum circle diameter of the pinion

Q6) a) Explain with neat sketch the force analysis of bevel gear. [8]

OR

a) Explain the strength rating of worm gearing.

b) A pair of worm gears is designated as 1/30/10/8 Calculate [8]
   i) The centre distance
   ii) The speed reduction
   iii) The dimensions of the worm and
   iv) The dimensions of the worm wheel

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**T.E. (Mechanical) (Part - III) (Semester - VI) (New) (Revised)
Examination, November - 2017
INTERNAL COMBUSTION ENGINES**
Sub. Code: 66841

Day and Date : Tuesday, 07 - 11 - 2017
Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions : 1) Attempt all the questions.
2) Make suitable assumptions if necessary and clearly mention them.
3) Figure to right indicate full marks.

Q1) a) Define the following terms [8]
   i) Clearance volume.
   ii) Swept volume.
   iii) Thermal efficiency.
   iv) Air standard efficiency.

OR

b) Classify IC Engine and explain each type with examples. [8]

c) Explain with neat sketch port timing diagram for two stroke petrol engine. [8]

Q2) a) A four cylinder, four stroke square engine running at 40 rev/sec has a carburetor venturi with a 3 cm throat. Assuming the bore to be 10 cm, volumetric efficiency of 75%, the density of air to be 1.15 kg/m³ and coefficient of air flow to be 0.75. Calculate, [9]
   i) Engine volume sucked per second and mass flow rate.
   ii) Suction pressure at throat.

b) Explain the following terms. [9]
   i) Air fuel ratio and its types.
   ii) Air fuel requirements for SI engine.
   iii) Petrol injection in SI engine.

OR

c) Explain the injection nozzles used in CI engine and its types. [9]

Q3) a) Write types of combustion chamber for SI engine and explain requirements of Combustion chamber. [8]

OR

b) Explain the factors influenced of engine variable on flame speed. [8]

c) Explain the effect of various engine variables on detonation. [8]

Q4) a) What modification is required, if the existing engine is to be supercharged? What are various methods of turbo charging? [8]

b) Explain with figure abnormal combustion in CI engine. Discuss for the control of knocking for CI engine. [8]

Q5) a) Discuss the various pollution norms and devices used for the control of engine emissions. [8]

b) What do you mean by induction swirl in combustion chamber of C I Engines? Discuss the advantages and disadvantages of the induction swirl. [8]

OR

b) What are the different methods to measure frictional power of ic engines. Explain Morse test. [8]

Q6) a) List the advanatges and disadvantages of supercharging of diesel engine. [7]

OR

a) Describe the sources for the production of Biodiesel and its advantages for utilization in IC engines. [7]

b) A four stroke petrol engine develops 50 kW and consumes 16 liters of petrol per hour of specific gravity 0.755. The calorific value of fuel used is 44500kJ/kg. Find its indicated thermal efficiency. If engine runs at 3000 rpm. It develops the mean effective pressure of 5.2 bar. Determine the bore and length of stroke if stroke length is 1.1X bore. [7]

c) Write notes on HC Emission and their control. [4]

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Seat
No.

T.E. (Mechanical) (Part - II) (Semester - VI) (Revised) Examination, November - 2017
INDUSTRIAL MANAGEMENT & OPERATIONS RESEARCH
Sub. Code: 66837

Day and Date :Wednesday, 01 - 11 - 2017
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) Assume suitable data, if necessary.
4) All questions are to be solved on one answer book only.

Q1) Attempt any four (5 Marks Each) **[20]**
   a) State the need of planning in manufacturing a component from vendors.
   b) Explain in brief Process of Organizing.
   c) Is there any difference between Authority & Responsibility. Justify your answer with suitable example.
   d) Discuss the implications of the Herzberg's theory as a strategy for motivating employees.
   e) Whether controlling is an essential function of management? If yes then explain the steps involved in controlling process?

Q2) Attempt any two (6 Marks Each) **[12]**
   a) Which factors related to environmental influence sugar manufacturing industry?
   b) What are the problems of SSI involved in manufacturing components of automobile sector?
   c) How to prevent an accident in a gas welding section of fabrication unit? Does the purchasing of safety equipments increases cost of operation?

Q3) Write short notes on any three (6 Marks Each) **[18]**
   a) Types of markets
   b) 4 P's of market
   c) Functions of Purchase department
   d) Purchase policy and procedure
   e) Cost estimation

P.T.O.

Q4) Attempt any three (6 Marks Each)   [18]

a) Define Operations Research. Briefly explain the characteristics of Operations Research.

b) Use graphical method to solve the following,

Maximize $Z = 5X_1 + 4X_2$

Subjected to constraints,

$5X_1 + 2X_2 \leq 40,$

$3X_1 + 3X_2 \leq 30$

$3X_1 + 5X_2 \leq 45$

$X_1, X_2 \geq 0.$

c) A company manufactures three jobs namely X, Y and Z. Each of the product require processing on three machines, Turning, Milling and Drilling. Product X requires 5 hours of turning, 2 hours of milling and 20 minutes of drilling. Product Y requires 3 hours of turning, 5 hours of milling and 30 minutes of drilling, and Product Z requires 1 hour of turning, 2 hours of milling and 30 minutes of drilling. In the coming planning period, 270 hours of turning, 220 hours of milling and 50 hours of drilling are available. The profit contribution of X,Y and Z are Rs. 500, Rs.750 and Rs. 1000 per unit respectively. Formulate LPP to maximize the profit. Suggest suitable method for solution of LPP.

d) Use simplex to solve the following problem and obtain initial and second feasible solution (two simplex tables only)

Minimise $Z = 5X_1 + 3X_2 + 2X_3$

subjected to constraints,

$3X_1 + 2X_2 + 2X_3 \leq 120,$

$2X_1 + 3X_2 + 3X_3 \leq 240$

$X_1, X_2, X_3 \geq 0.$

Q5) Attempt any two (7 Marks Each)   [14]

a) How does the problem of degeneracy arise in a transportation problem? Explain how one can overcome it?

b) The unit transportation cost along with capacity and requirements from a supplier to a restaurant is as given below

Supplier	Restaurant				Capacity
	1	2	3	4	
A	25	40	75	20	4000
B	50	40	65	25	3000
C	25	50	70	40	3000
Requirements	1600	2400	3000	2000	

Obtain initial basic feasible solution by least cost method & VAM

c) A company has four workers and five jobs. Expected profit in Rs. for each job when assigned to different workers is given in the matrix below. Solve the assignment problem & estimate the total profit

Worker	Jobs				
	A	B	C	D	E
1	60	76	48	99	80
2	69	82	59	71	57
3	85	90	109	69	79
4	46	62	85	75	78

Q6) Write short notes on any three (6 Marks Each)　　　　　　　　**[18]**

a) Explain the various quantitative methods that are useful for decision making under risk.

b) The following matrix gives the payoff (in Rs.) of different strategies against events.

Strategies	Events			
	E_1	E_2	E_3	E_4
S_1	4,000	100	6,000	18,000
S_2	20,000	5,000	400	0
S_3	20,000	15,000	2,000	1,000

What will be your decision under the following approaches

i) Optimistic Criterion

ii) Pessimistic Criterion

iii) Leplace Criterion

iv) Hurwicz Criterion ($\alpha = 0.7$)

c) Draw the project network for the following activities and determine critical path and project duration.

Activity	Preceding activity	Duration (days)
A	-	8
B	A	12
C	A	8
D	B,C	7
E	A	8
F	D,E	17
G	C	21
H	F,G	9
I	H	11

d) Determine optimal sequence, elapsed time and idle time of the following six jobs on the machine M1,M2 and M3 used in the same sequence to process these jobs.

Machines	Jobs					
	J1	J2	J3	J4	J5	J6
M1	15	14	16	13	10	8
M2	8	10	7	15	11	9
M2	8	10	7	15	11	9

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Seat
No.

T.E. (Mech.) (Part - III) (Semester - VI) (Pre-revised) (Old) Examination, November - 2016
MACHINE DESIGN - II
Sub. Code : 45568

Day and Date :Monday, 07-11-2016   Total Marks : 100
Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) Answer any three questions from Section - I and any three questions from Section - II.
2) Figures to the right indicate full marks.
3) Assume suitable Data/ assumptions if required and state them clearly.
4) Use of non-programmable calculator is permitted.
5) Draw neat diagrams wherever necessary.

SECTION - I

Q1) a) Define stress concetration. What are the causes and remedies over stress concentration? **[8]**

b) The work cycle of mechanical component is subjected to completely reversed bending stresses consists of following three elements:

i) ± 350 N/mm^2 for 85% of time.

ii) ± 400 N/mm^2 for 12% of time.

iii) ± 500 N/mm^2 for 3% of time.

The material for component is 50C4 ($S_{ut} = 660$ N/mm^2) and corrected endurance strength of the component is 280 N/mm^2. Determine the life of the component. **[8]**

Q2) a) State and explain important steps in design for manufature (DFM). **[8]**

b) Explain different wear mechanisms associated with tribology. **[8]**

Q3) a) Derive Stribek's equation for rolling contact bearing with assumptions made. **[8]**

b) A ball bearing is operating on a work cycle of three parts, A radial load of 2000 N at 1440 rpm, for 30% of cycle; radial load of 4500 N at 720 rpm for 60% of cycle and radial load of 3000 N at 1440 rpm for remaining part of cycle. Consider the work cycle of 1 minute. The expected life of bearing is 11,000 hours. Calculate dynamic load capacity of the bearing.**[8]**

Q4) a) Describe with neat sketches the construction and working principles of Hydrodynamic and Hydrostatic bearings. **[8]**

b) A following data is given for a 360° hydrodynamic bearing, **[10]**

Journal diameter = 100 mm, Bearing length = 100 mm,

Radial load = 50 kN, Journal speed = 1440 r.p.m.,

Radial clearance = 0.12 mm, Viscosity of lubricant = 16 cP

Calculate :

i) Minimum film thinckness

ii) Coefficient of friction

iii) Power lost in friction

Refer following table:

l/d	ε	h_o/C	s	φ	(r/C) f	Q/(rCn$_s$l)
	0.4	0.6	0.264	63.10	5.79	3.99
	0.6	0.4	0.121	50.58	3.22	4.33
1	0.8	0.2	0.0446	36.24	1.70	4.62
	0.9	0.1	0.0188	26.45	1.05	4.74
	0.97	0.03	0.0047	15.47	0.514	4.82

Where l = bearing length in mm, d = jouranl dia. mm, ε = eccentricity ratio, s = Sommerfeld no., r = radius of journal mm, φ = attitude angle, f = Coefficient of Friction, Q = flow of lubricant mm³/ sec, n_s = journal speed (rev/s)

Q5) a) Derive expression for beam strength of spur gear tooth, stating the assumptions made. **[6]**

b) A pair of spur gears consists of a 24 teeth pinion, rotating at 1000 rpm and transmitting power to a 48 teeth gear. The module is 6 mm and face width is 60 mm. Both the gears are made of steel with an ultimate tensile strength of 450 N/mm². The gears are heat treated to a surface hardness of 250 BHN. Assume that velocity factor accounts for the dynamic load and use Y = 0.337 for 24 teeth. **[10]**

Calculate

i) Beam strength

ii) Wear strength

iii) The rated power that the gears can transmit if service factor and factor of safety are 1.5 and 2, respectively.

Q6) a) Explain with neat sketch the concept of virtual number of teeth and its significance in design of helical gear. **[6]**

b) A pair of parallel helical gears consists of 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20°, while the helix angle is 25°. Face width is 40 mm and normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 (S_{ut} = 600N/mm²) and heat treated to a surface hardness of 300 BHN. The service factor and factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for dynamic load and calculate the power transmitting capacity of gears. **[10]**

No.of teeth (Z)	22	23	24	25	26	27	28
Y	0.330	0.333	0.337	0.340	0.344	0.348	0.352

Q7) a) Explain with neat sketches the following terms in reference to Bevel gears. **[8]**

     i) Pitch cone

     ii) Pitch angles for pinion and gear

     iii) Cone distance

     iv) Back cone radius

b) A pair of bevel gears, with 20° pressure angle consists of 20 teeth pinion meshing with a 30 teeth gear. The module is 4 mm, while face width is 20 mm. The material for the pinion and gear is steel 50C4 with an ultimate tensile strength of 750 N/mm². The gear teeth are lapped and ground and surface hardness is 400 BHN. The pinion rotates at 500 rpm and receives 2.5 KW power from the electric motor. The starting torque of the motor is 150% of rated torque. Determine factor of safety against bending failure and against pitting failure. Take error(e) = 0.0125, deformation factor (C) = 11400 N/mm² **[10]**

Take Lewis form factor 'Y' as in table below

No.of teeth (Z)	22	23	24	25	26	27	28
Y	0.330	0.333	0.337	0.340	0.344	0.348	0.352

Q8) a) Explain with neat sketch force analysis of Worm and Worm Wheel. **[6]**

b) A pair of worm gear is designated as1/40/10/4 has an effective surface area of 0.25 m². The input speed of worm shaft is 1000 rpm. A fan is mounted on the worm shaft to circulate air over the surface of the fins. The coefficient of heat transfer can be taken as 25 W/m² °C. The permissible termperature rise of the lubricating oil above the atmospheric temperature is 45° C. The coefficient of friction is 0.035 and the normal pressure angle is 20°. Calculate the power transmitting capacity based on thermal considerations. **[10]**

T.E.(Mech.) (Part-III) (Semester - VI)
Examination, November - 2016
RENEWABLE ENERGY ENGINEERING
Sub. Code :45569

Day and Date :Tuesday, 8 - 11 - 2016   Total Marks : 100
Time : 10.30 a.m. to 1.30 p.m.

Instructions :   1)   Solve any three questions from each section.
2)   Figures to the right indicate full marks.
3)   Assume data if necessary.

SECTION-I

Q1) a)   Explain the non-renewable energy resources status in World.   [8]

b)   Discuss the importance of renewable energy and its status in India.   [8]

Q2) a)   State the applications of solar energy and discuss one application in detail.   [8]

b)   Describe the solar flat plate collector with neat sketch.   [8]

Q3) a)   State PV-cell applications, advantages and disadvantages.   [8]

b)   Describe the photo - voltaic cell materials.   [8]

Q4) Write short notes. (Any Three).   [18]

a)   Solar pond

b)   Fuel cells

c)   Testing of solar collectors

d)   Solar energy storage.

P.T.O.

Q5) a) Explain the criteria for selection of site for Wind energy conversion. [8]

b) Discuss the present status of wind energy in India [8]

Q6) a) Explain the concept of energy plantation and state its importance. [8]

b) State the importance of bio-fuels and list its applications. [8]

Q7) a) Explain the working of geothermal power plant. State its disadvantages.[8]

b) Describe the closed cycle OTEC system with neat sketch. [8]

Q8) Write short notes (Any Three). [18]
   a) Energy audit
   b) ECOs and ECMs
   c) Wind-PV hybrid system
   d) Hybrid vehicles

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Seat
No.

T.E (Mechanical) (Part-II) (Semester-VI) (Old) Examination, November - 2016
INTERNAL COMBUSTION ENGINES
Sub. Code :45570

Day and Date : Wednesday, 09 - 11 - 2016   Total Marks : 100
Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) Answer any three questions from each section.
2) Figures to the right indicates full marks.
3) Draw neat sketches wherever necessary.
4) Assume suitable data wherever necessary.
5) Use of non-programmable calculator is allowed.

SECTION-I

Q1) a) Classify the I.C. engines on different criteria.   [7]

b) In a constant volume 'OHo cycle' the pressure at the end of compression is 15 times that at the start, the temperature of air at the begining of compression is 38°c, and maximum temperature attained in the cycle is 1950°c. Determine.

i) Compression ratio.

ii) Thermal efficiency of the cycle.

iii) Work done. Take γ for air=1.4   [9]

Q2) a) What are the various sensors used in electronic fuel injection system?   [6]

b) Explain port timing diagram for two stroke petrol engine with neat sketch.[6]

c) Explain with figure working of simple carburettor.   [5]

Q3) a) What is ignition log? What is effect of engine variables on flame propagation?   [9]

b) Which are the different types of combustion chambers are used in S-I engines? Explain any one of them with neat sketch.   [8]

P.T.O.

Q4) a) Comment on the following statement. [8]

    i) S.F.C of supercharged CI engine is lower than naturally aspirated engine.

    ii) Size of CI engine is larger the SI engine.

    b) Discuss the limitations of super charging of SI engine and CI engine.[8]

SECTION-II

Q5) a) With neat sketch explain distributor fuel injection system of CI engine.[6]

    b) Explain the terms formation of spray atomization and penetration. [6]

    c) Explain centrifugal governor with neat sketch. [5]

Q6) a) Explain the phenomenon of knocking in diesel engine. What is the effect of engine variables on diesel knock. [9]

    b) Give the classification of CI engine combustion chamber. What is 'M' combustion chamber? What are its advantages? [8]

Q7) a) Define

    i) Brake thermal efficiency. [5]

    ii) Mechanical efficiency.

    iii) Volumetric efficiency.

    iv) Brake specific fuel consumption.

    v) Indicated thermal efficiency.

    b) During a test on a single cylinder two stroke water cooled CI engine following readings were obtained. [11]

    i) Cylinder diameter =226 mm

    ii) Stroke length=292 mm

    iii) IMEP = 6.7 bar

    iv) Engine speed = 1800 rpm

    v) Mechanical efficiency = 78%

vi) Fuel used 60 kg/hr

vii) Specific gravity of fuel = 0.83

viii) Airfuel ratio = 30 :1

ix) Exhaust gas temperature = 367°c

x) Ambient tempt = 33°c

xi) Calorific value = 44200 kJ/kg.

xii) Sp. Heat of gas = 1.1kJ/kg

Calculate

1) B.S.F.C.

2) Brake thermal efficiency.

3) Heat carried by exhaust gas.

Q8) Write a short notes on any four. [16]

a) Selection of engine for manne application.

b) CI engine emission and control.

c) Delay period in C I engine.

d) Performance parameters for testing of I.C. engines.

e) Cetane number and additives.

f) Electronic diesel injection system.

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T.E. (Mechanical - II) (Semester - VI) (Pre-Revised) (Old) Examination, November - 2016
INDUSTRIAL FLUID POWER
Sub. Code : 45571

Day and Date : Thursday, 10-11-2016   **Total Marks : 100**
Time : 10.30 a.m. to 1.30 p.m.

Instructions :   1)   Solve any three questions from each section.
2)   Make suitable assumptions if required and state it clearly.
3)   Draw neat sketches whenever necessary.

SECTION - I

Q1) a)   What are the factors affecting selection of hydraulic fluids. Elaborates in detail.   [8]

   b)   Explain construction and working of hydraulic powerpack used in hydraulics systems.   [8]

Q2) a)   Elaborate various types of seals used in hydraulics and discuss their features.   [8]

   b)   Explain construction, working and applications of telescopic type cylinder used in hydraulics.   [8]

Q3) a)   What are the different source of contamination in hydraulic fluids, elaborates in detail.   [8]

   b)   Draw neatly regenerative circuit used in hydraulics using appropriate ISO symbols and explain its working.   [8]

P.T.O.

Q4) Write short note on (Any Three) [18]

    a)   Hydraulic Sealing Material.

    b)   Pressure intensifiers in hydraulics.

    c)   Non return valves.

    d)   Hydraulics plumbing.

    e)   Maintenance and trouble shooting of hydraulic system.

SECTION - II

Q5) a)   What is pneumatics? What are different applications of pneumatics systems? [8]

    b)   Classify air compressors and explain working of any compressor with a neat sketch. [8]

Q6) a)   Explain working of pneumatics servo system with a neat sketch. [8]

    b)   Explain with neat sketch working of time delay valve used in pneumatics.[8]

Q7) a)   Draw a pneumatic circuit for sequencing of two pneumatic actuators using appropriate ISO symbols and explain its working. [8]

    b)   Explain the concepts of fluidics and applications of fluidics. [8]

Q8) Write a short note on (Any Three) [18]

    a)   FRL system in Pneumatics.

    b)   Quick exhaust valve.

    c)   Pneumatic sensors.

    d)   Industrial application of pneumatics.

    e)   5/2 Direction control valve.

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Seat No.

T.E. (Mechanical) (Part - II) (Semester - VI) (Revised) (New) Examination, November - 2016
INDUSTRIAL MANAGEMENT & OPERATIONS RESEARCH
Sub. Code : 66837

Day and Date :Monday, 07-11-2016   **Total Marks : 100**
Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) All question are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data, if necessary.
4) All questions are to be solved on one answer book only.

Q1) Attempt any four (5 marks each):   **[20]**

a) What do you mean by management environment?

b) Explain limitations of planning.

c) Distinguish between formal and informal organization.

d) Write steps in recruitment procedure.

e) Which leadership style will you prefer and why.

Q2) Attempt any four (5 marks each):   **[20]**

a) Summaries all target marketing strategies.

b) Elaborate on promotion mix and its effectiveness.

c) State objectives of costing.

d) Explain five purchasing principles.

e) Discuss the duties of material manager.

Q3) Attempt any two (5 marks each):   **[10]**

a) List the qualities required to become a good entrepreneur.

b) Write steps in ISO 9000 implementation steps.

c) State the measures to prevent electrical accidents.

P.T.O.

Q4) Attempt any three (5 marks each):

a) State various O.R. techniques and their applications.

b) A person wants to decide the constituents of diet which will fulfil his daily requirements of proteins, fats and carbohydrates at the minimum cost. The choice is to be made from four different types of foods. The yields per unit of these foods are given in table below.

Food Type	Yield per unit			Cost per unit
	Proteins	Fats	Carbohydrates	
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Minimum requirement	800	200	700	-

Formulate LPP.

c) Use graphical method to solve the following,

Maximize $Z = 400 x_1 + 300 x_2$

Subjected to constraints,

$$3x_1 + 2x_2 \leq 120,$$
$$3x_1 + 5x_2 \leq 150$$
$$8x_1 + 6x_2 \leq 240$$
$$x_1, x_2 \geq 0.$$

d) Use simplex to solve the following problem and obtain initial and second feasible solution (iteration one only).

Maximize $Z = 2 x_1 + x_2$

Subjected to constraints,

$$3x_1 + 2x_2 < 12,$$
$$x_1 + 2.3x_2 \leq 6.9$$
$$x_1 + 1.4x_2 \leq 4.9$$
$$x_1, x_2 \geq 0.$$

Q5) Attempt any three (5 marks each):

a) Write a short note on travelling salesman problem.

b) A company has four salesmen and four territories for Marketing of a Product. Each of the salesmen can work in each of the territory. Profits in thousands of rupees taken for each of the salesman to each of the territory is given in the matrix below. Which territory should be assigned to which territory?

Task	Machines			
	A	B	C	D
1	51	77	49	55
2	32	34	59	68
3	37	44	70	54
4	55	55	58	55

c) The transportation cost along with capacity and requirements from a supplier to a restaurant is as given below.

Supplier	Restaurant				Capacity
	1	2	3	4	
A	11	13	10	0	30,000
B	15	13	16	0	70,000
C	14	13	18	0	1,35,000
Requirements	30,000	60,000	1,20,000	25,000	

Obtain initial basic feasible solution by VAM.

d) Is the solution obtained above optimal? If not using suitable method, carry out one iteration to obtain an improved solution.

Q6) Attempt any four (5 marks Each):   **[20]**

a) Which techniques are used to solve decision making under uncertainty.

b) Draw the project network for the following activities.

Activity	A	B	C	D	E	F	G	H	I	J
Preceding activity	-	A	A	A	C	D	B	G	E,H	F

c) If activity durations for above activities are as below, determine critical path and project duration by using forward and backward pass computation.

Activity	A	B	C	D	E	F	G	H	I	J
Duration (days)	1	4	3	4	3	2	1	4	2	2

d) The payoff matrix for a problem is given as below.

Strategies	Events			
	E1	E2	E3	E4
S1	0	15	30	40
S2	25	0	15	30
S3	50	25	0	15
S4	75	50	25	0

What will be your decision if Maximin, Maximax, Laplace and Hurwics ($\alpha = 0.4$) criterion is applied.

e) Determine optimal sequence, elapsed time and idle time (in hrs.) of the following six jobs on the machine A and B used in the same sequence to process there jobs.

Job	J1	J2	J3	J4	J5	J6
Machine A	4	10	16	10	12	9
Machine B	8	9	8	6	12	2

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T.E.(Mechanical) (Semester - VI) (New) (Revised) Examination, November - 2016
INDUSTRIAL FLUID POWER
Sub. Code :66838

Day and Date :Tuesday, 8 - 11 - 2016

Total Marks : 100

Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) All questions are compulsory.
2) Make suitable assumptions if required
3) Draw neat diagrams/ sketches wherever necessary.
4) Figures to right indicate full marks.

Q1) Solve any two:

a) List main components of fluid power system and explain their functions in detail. [7]

b) Explain the advantages and limitations of using petroleum based hydraulic oils. [7]

c) Write the advantages and applications of fluid power with respect to machine tool applications. [7]

Q2) Solve any three:

a) Explain special type of cylinders used in hydraulics with neat sketch (any two) [6]

b) With a neat sketch explain working of internal gear pump. [6]

c) Explain with a suitable circuit how an accumulator can be used as an emergency power source. [6]

d) Explain with neat sketch heat exchangers used in hydraulic systems. [6]

P.T.O.

Q3) Solve any three:

a) What do you mean by synchronization of cylinder motion? Explain various methods to obtain it.
[6]

b) Explain the operation of a check valve with neat sketch.
[6]

c) Explain the construction and working of a counterbalance valve with neat sketch.
[6]

d) Write a note on pressure-temperature compensated flow control valve. [6]

Q4) Solve any three:

a) Classify compressors and draw sketch of a two stage reciprocating compressor.
[6]

b) Explain different types of direction control valves used in pneumatics. [6]

c) Explain with neat sketch diaphragm type actuators used in pneumatics. [6]

d) Compare air, hydraulic and electric motors.
[6]

Q5) Solve any three:

a) Explain use of a counterbalance valve in a hydraulic circuit.
[6]

b) Explain in brief, important considerations to be taken into account while designing a hydraulic circuit.
[6]

c) What is a time delay circuit? Discuss with an example.
[6]

d) Highlight the advantage of regenerative circuit and explain it with a suitable application.
[6]

Q6) Solve any two:

a) List out four operating problems associated with pumps and valves, also enlist possible causes and remedies for each problem.
[7]

b) Write a note on hydraulic and pneumatic servo system for linear motion.
[7]

c) Write a note on fluidics.
[7]

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Seat
No.

T.E. (Mechanical) (Part-III) (Semester-VI) (Revised) Examination, November - 2016
METROLOGY AND QUALITY CONTROL
Sub. Code :66839

Day and Date : Wednesday, 09 - 11 - 2016   Total Marks : 100
Time : 10.30 a.m. to 1.30 p.m.

Instructions :   1)   Answer any three questions from Sections I and three questions from Sections II.
                 2)   Figures to the right indicate full marks.
                 3)   Make suitable assumptions wherever necessary.

SECTION-I

Q1) a) Discuss and compare unilateral and bilateral dimensioning systems. **[8]**

   b) Draw a figure showing the disposition of gauge manufacturing tolerance and wear allowance for work shop grade, inspection grade, and general grade GO and NO-GO plug gauges.   **[8]**

Q2) a) Discuss working principle, advantages and limitations of Plunger type dial indicator with a neat sketch.   **[8]**

   b) Describe the procedure and derive an expression for measurement of radius of a large spherically concave surface.   **[8]**

Q3) a) Describe the steps involved in computing flatness of surface plate. **[8]**

   b) Discuss with a neat sketch Taylor Hobson Talysurf.   **[8]**

Q4) Write short notes on (any three)   **[18]**

   a)   International prototype meter.

   b)   Importance of limits system in mass production.

   c)   Optical Flat.

   d)   Autocollimator.

SECTION-II

Q5) a) Derive the expression for measurement of effective diameter of thread by using 'Two wire method, and discuss the benefits of using best size wire. [8]

b) List various methods used for tooth thickness measurement of spur gear and discuss any one method in detail. [8]

Q6) a) Discuss the factors that control the quality of design and quality of conformance . [8]

b) What is cost of quality? Discuss the components of quality costs. [8]

Q7) a) Draw ND curve and discuss its importance in statistical quality control. [8]

b) Discuss the significance of operating characteristic curve in sampling inspection. [8]

Q8) Write short notes on (any three) [18]

a) Thread micrometer

b) Inspection of profile of gear tooth.

c) Cause and effect diagram

d) C chart.

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T.E. (Mechanical) (Semester - VI) (Revised) (New) Examination, November - 2016
MACHINE DESIGN - II
Sub. Code : 66840

Day and Date : Thursday, 10-11-2016

Time : 10.30 a.m. to 1.30 p.m.

Total Marks : 100

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data wherever necessary.
4) Use of Non-programmable calculator is allowed.

SECTION - I

Q1) a) Define notch sensitivity. Explain its significance in design of components subjected to fluctuating loads. [8]

OR

a) Describe the process of fatigue design under combined stresses. [8]

b) A Machine shaft carries a pulley between two bearings. The bending moment at the pulley varies from 200 N-m to 600 N-m and the torsional moment in the shaft varies from 70 N-m to 200 N-m. The frequencies of variation of bending and torsional moments are equal to the shaft speed. The shaft is made of steel FeE 400 (Sut = 540 N/mm² and Syt = 400 N/mm²) and the corrected endurance strength of shaft is 200N/mm². Determine the diameter of the shaft using factor of safety of 2. [10]

Q2) a) Explain the role of friction, wear lubrication in the design of bearings. [6]

OR

a) Explain significance of DFM and its effect on design quality. [6]

P.T.O.

b) A machine shaft rotating at 720 rpm and transmitting power from the pulley P to the spur gear G is shown in Fig. 1. The belt tensions and the gear tooth forces are as follows:P_1 = 498N, P_2 = 166N, P_3 = 497N, Pr = 181N.   [10]

The weight of the pulley is 100 N. The diameter of the shaft at bearings B_1 and B_2 is 10 mm and 20 mm respectively. The load factor is 2.5 and the expected life for 90% of the bearings is 8000 h. Select single-row deep groove ball bearings at B_1 and B_2. Refer fig.2 for data.

Fig. 1: Machine Shaft

Principal Dimensions (mm)			Basic Load Ratings (N)		Designation
d	D	B	C	Co	
10	19	5	1480	630	61800
	26	8	4620	1960	6000
	30	9	5070	2240	6300
	35	11	8060	3750	6300
12	21	5	1430	695	61801
	28	8	5070	2240	6001
	32	10	6890	3100	6201
	37	12	9750	4650	6301
20	32	7	2700	1500	61804
	42	8	7020	3400	16404
	42	12	9360	4500	6004
	47	14	12700	6200	6204
	52	15	13900	7800	6304
	72	19	30700	16600	6404

Fig. 2: Parameters for Single-row deep groove ball bearings

Q3) a) Explain Reynold's equation along with the assumptions considered. [8]

OR

a) What are the various Tribological considerations used in design of bearings. [8]

b) A following data is given for a 360° hydrodynamic bearing. [8]

Journal diameter = 100 mm

Bearing length = 100 mm

Radial load = 50 KN

Journal speed = 1440 rpm

Radial clearance = 0.12 mm

Viscosity of lubricant = 16 Cp

Calculate:

i) Minimum oil film thickness

ii) Coefficient of friction

iii) Power lost in friction

Refer following data Table:

l/d	ε	h_o/C	S	φ	(r/C)f	Q/(rCn$_s$l)
	0.4	0.6	0.264	63.10	5.79	3.99
	0.6	0.4	0.121	50.58	3.22	4.33
1	0.8	0.2	0.0446	36.24	1.70	4.62
	0.9	0.1	0.0188	26.45	1.05	4.74
	0.97	0.03	0.0047	15.47	0.514	4.82

SECTION - II

Q4) a) Derive an expression for Lewis equation of spur gear tooth. Also state the assumptions made For deriving the same. [8]

OR

a) Describe in detail the terminology of spur gears with neat sketches. [8]

-3-

b) A pair of spur gears with 20° full-depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. the material for pinion as well as gear is steel (Sut = 600 N/mm²). The gears are heat-treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75. Assume that velocity factor accounts for the dynamic load and the factor of safety is 1.5. The Lewis from factor of 0.32 for 20 teeth. Determine the rated power that the gear can transmit. [10]

Q5) a) Explain the force analysis in the design of helical gears. [6]

OR

a) Explain the concept of virtual number of teeth and its significance in the design of helical gears. [6]

b) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20°, while the helix angle is 25°. The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 (Sut = 600 N/mm²) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. Take Y = 0.3475. [10]

Q6) a) Explain with the neat sketch the following terms in reference to bevel gears. [8]
   i) Pitch Cone
   ii) Pitch angles for pinion and gear
   iii) Cone distance
   iv) Back Cone

b) A pair of worm and worm wheel is designated as 2/54/10/5. [8]
Determine:
   i) Center distance.
   ii) Speed reduction.
   iii) Dimensions of worm.
   iv) Dimesnsions of worm wheel.

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T.E.(Mechanical) (Part - III) (Semester - VI) (New) (Revised) Examination, November - 2016
INTERNAL COMBUSTION ENGINES
Sub. Code : 66841

Day and Date : Friday, 11 - 11 - 2016
Time : 10.30 a.m. to 1.30 p.m.

Total Marks : 100

Instructions :   1)   Attempt all the questions.
                 2)   Make Suitable assumptions if necessary and clearly mention them.
                 3)   Figures to right indicate full marks.

Q1) Solve any two from the following:

a)   Write down the difference between S.I. engines and C.I. engines. State the applications of I.C.Engines.   [8]

b)   Explain why actual cycle efficiency of engine is lower than air standard efficiency?   [8]

c)   Draw and explain port timing diagram for 2-Strokes S.I. engine.   [8]

Q2) Solve the following:

a)   What are the modern systems added in the simple carburetor to become a complete carburetor.   [9]

OR

a)   What are the advantages of gasoline injection system? Explain electronic gasoline injection system with its merits and demerits.   [9]

b)   A simple jet carburetor is required to supply 5 kg of air and 0.5 kg of fuel per minute. The fuel specific gravity is 0.75. The air is initially at 1 bar and 300 K. Calculate the throat diameter of choke for a flow velocity of 100 m/s. Velocity coefficient is 0.8. If the pressure drop across the fuel metering orifice is 0.8 of throat of the choke, calculate orifice diameter assuming, $Cd = 0.6$ and $\gamma = 1.4$ [9]

Q3) Solve any two from the following:

a) What is ignition lag? Explain the effect of engine variables on ignition lag. [8]

b) What is octane number? How it is found? What are the additives used to improve the octane number? [8]

c) What are the basic requirements of a good S.I. engine combustion chamber? [8]

Q4) a) Explain the stages of combustion in CI engines. [6]

b) What is Knocking in CI engines? What are the different methods used to reduce the knocking? [6]

c) What is meant by "cetane number" state how this number is identified for the rating of fuel. [4]

Q5) a) Define: [8]

i) Performance curve.

ii) Mechanical efficiency.

iii) Break thermal efficiency.

iv) BSFC.

OR

a) What do you mean by heat balance sheet of IC engine? Explain how engine heat balance sheet is prepared. [8]

b) A Four stroke four cylinder SI Engine has a compression ratio of 7.5. The net brake load is 21.5 kg and brake arm length is 50 cm. IMEP is 7.5 bar, speed is 3000 rpm, fuel consumption is 10.8 kg/min, CV of fuel is 44 MJ/kg. The bore is 8.6 cm and stroke is 10 cm, Find: [10]

i) Mechanical Efficiency

ii) Brake thermal efficiency

iii) Brake Mean Effective Pressure

iv) Air standard and Relative efficinecy

Assume Calorific value of fuel as 43,000 kJ/kg.

Q6) Write Short notes:

a) Effect of supercharging on engine performance.

b) Combustion chambers of CI engines.

c) Pollution control and GHG gases.

d) Advances in hybrid vehicles.

Seat No.	

T. E. (Mechanical) (Part - II) (Semester - VI) (Revised) Examination, April - 2017

INDUSTRIAL MANAGEMENT & OPERATIONS RESEARCH

Sub. Code : 66837

Day and Date : Wednesday, 26-04-2017

Time : 2.00 p.m. to 5.00 p.m.

Total Marks :100

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data, if necessary.
4) All questions are to be solved on one answer book only.

Q1) Attempt any four. [20]

a) Illustrate various functions of management.

b) Responsibility should have equal authority. Justify this statement.

c) State functions of staffing.

d) List the characteristics of a good leader.

e) Explain the barriers of communication.

Q2) Attempt any four. [20]

a) Summaries all pricing strategies.

b) Elaborate on advertising media and its effectiveness.

c) How will you relate elements of cost with selling price?

d) Explain importance of material management.

e) Discuss methods of vendor rating.

Q3) Attempt any two. [10]

a) Define small scale industry and list objectives of SSI.

b) Write benefits of implementing ISO 9000.

c) State the measures to prevent accidents due to mechanical factors.

Q4) Attempt any three.   [15]

a)   Define terms basic variables, slack variables, surplus variables, artifical variables and optimal solution with respect to LPP.

b)   A firm uses lathe, milling machine and grinding machine two produce two machine parts I and II. Following table represent the machining time required for each part, the machining times available on different machines and the profit on each part.

Types of machine	Machine time in min.		Max time available per week in min.
	I	II	
Lathe	12	6	3000
Milling machine	4	10	2000
Grinding machine	2	3	900
Profit per unit (Rs.)	40	100	

Formulate L.P.P. for above problem.

c)   Solve above problem by graphical method.

d)   Use simplex to solve the following problem and obtain initial and second feasible solution (two simplex tables).

Maximize $Z = 10x_1 + 6x_2 + 6x_3$

subjected to constraints,

$3x_1 + 2x_2 + 2x_3 \leq 240$,

$2x_1 + 3x_2 + 3x_3 \leq 470$

$x_1 \leq 430$

$x_1, x_2, x_3 \geq 0$

Q5) Attempt any three.   [15]

a)   Obtain mathematical statements of assignment problem.

b)   A firm has three factories located at Ahmedabad, Ernakulam and Kanpur which produce the same product. There are four major distribution centers situated in Delhi, Bombay, Madras and Calcutta. The daily production in terms of units produced varies from factory to factory as given below:

Factory:	Ahmedabad	Ernakulam	Kanpur
Production(Units per day):	30	40	50

Average daily demand at the distribution centers is as follows:

Centre:	Bombay	Calcutta	Delhi	Madras
Demand(Units per day):	35	28	32	25

The transport cost from each factory to each distribution centre is as under:

	Bombay	Calcutta	Delhi	Madras
Ahmedabad	6	5	8	5
Ernakulam	5	11	9	7
Kanpur	8	9	7	13

Obtain an initial feasible solution using north-west-corner rule?

c) Is the solution obtained above optimal? If not using suitable method, carry out one iteration to obtain an improved solution.

d) Well-done Company has taken the third floor of a multistoried building for rent with a view to locate one of their zonal offices. There are five main rooms in this floor to be assigned to five managers. Each room has its own advantages and disadvantages. Each of the five managers were asked to rank their room preferences amongst the rooms 301, 302, 303, 304 and 305.

Their preferences were recorded in a table as indicated below.

	M1	M2	M3	M4	M5
301	-	4	2	-	1
302	1	1	5	1	2
303	2	-	1	4	-
304	3	2	3	3	3
305	-	3	4	2	-

Most of the managers did not list all the five rooms since they were not satisfied with some of these rooms and they left off these from the list. Find out as to which manager should be assigned to which room so that their total preference ranking is minimum.

Q6) Attempt any four. [20]

a) Write a short note on decision tree.

b) Draw the project network for the following activities.

Activity	A	B	C	D	E	F	G	H	I	J	K
Preceding activity	-	-	-	B	C	A	D,E	D,E	F,G	H	I,J

c) If activity durations for above activities are as below, determine critical path and project duration by using forward and backward pass computation.

Activity	A	B	C	D	E	F	G	H	I	J	K
Duration	8	5	13	12	6	6	7	9	8	2	6

d) A company is making a large boiler installation. A certain automatic monitoring unit is critical for the operation of the whole system. At the time of original order, the spares for the unit can be purchased for Rs. 2000 per unit. It is found that maximum 3 failures can occur in lifespan of boiler. The probability of failure of the unit is as given below,

Failure	0	1	2	3
probability	0.35	0.45	0.15	0.05

If the spare is not available the total cost of idle time and replacement will be Rs. 1500. The unused spares have no salvage value.

Prepare pay-off and regret table for number of spares to be purchased and suggest solution.

e) Determine optimal sequence, elapsed time and idle time (in hrs.) of the following six jobs on the machine 1 and 2 used in the same sequence to process these jobs.

Job	J1	J2	J3	J4	J5	J6
Machine 1	7	4	2	5	9	8
Machine 2	3	8	6	6	4	1

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Seat
No.

T.E. (Mechanical) (Semester - VI) (Revised)
Examination, April - 2017
INDUSTRIAL FLUID POWER
Sub. Code : 66838

Day and Date : Friday, 28 - 04 - 2017   **Total Marks : 100**
Time : 2.00 p.m. to 5.00 p.m.

Instructions :   1)   All questions are compulsory.
                   2)   Draw neat diagrams/sketches wherever required.
                   3)   Figures to right indicate full marks.

Q1) Solve any two:

a)   Compare hydraulics and pneumatics giving detailed application ranges.[7]

b)   Explain different types of hydraulic fluids and their selection criterias.[7]

c)   Draw the symbols for the following elements: [7]

   i)   Counterbalance Valve

   ii)   Three way, two position D.C valve.

   iii) Silencer

   iv)   Double acting intensifier

   v)   Double Acting cylinder

   vi)   Twin pressure valve

   vii) Air motor.

Q2) Solve any three:

a)   Draw a neat sketch of unbalanced vane pump and explain its working.[6]

b)   Mention the different types of mountings used in fixing the hydraulic
     cylinders.   [6]

c)   What are the important locations of filters explain them with neat circuit
     diagrams.   [6]

d)   Explain with neat sketch different types of seals used in hydraulic circuits.
                                                                        [6]

P.T.O.

Q3) Solve any three:

a) Draw and explain different center positions for D.C valve in hydraulic systems.

[6]

b) Draw neat sketch of a pilot operated Pressure relief valve. [6]

c) Explain the working of Temperature compensated flow control valve with neat sketch.

[6]

d) Explain the requirements of pressure control, direction control and flow control valves used in hydraulic systems.

[6]

Q4) Solve any three:

a) Explain with neat sketch working of reciprocating compressor used in pneumatic systems.

[6]

b) With the help of neat sketch explain the working of air filter. [6]

c) Explain with the help of neat sketch the construction and working of pressure regulator used in pneumatic system.

[6]

d) Classify direction control valves and explain with help of symbols D.C valves with ports and switching positions.

[6]

Q5) Solve any three:

a) Draw and explain circuit for the following operation [6]
   i) rapid approach
   ii) controlled feed
   iii) quick return of drilling machine in hydraulic system.

b) Explain the bleed-off circuit used in hydraulic system. [6]

c) With the aid of circuit diagram explain the working principle of Quick exhaust valve used in pneumatics.

[6]

d) Explain regenerative principle and derive the condition for force and speed in extension and retraction to be identical.

[6]

Q6) Write short notes on: (Solve any two)

a) Hydraulic servo system.

b) Troubleshooting of Pneumatic system. [7]

c) Pneumatic sensors. [7]

[7]

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T.E. (Mechanical) (Semester-VI)
(Revised) Examination, May - 2017
MACHINE DESIGN - II
Sub. Code : 66840

Day and Date : Thursday, 04-05-2017
Time : 2.00 p.m. to 5.00 p.m.

Total Marks : 100

Instructions :   1)   Figures to the right indicate full marks.
                 2)   Assume suitable data wherever necessary.
                 3)   Use of Non-programmable calculator is allowed.

Q1) a)   Explain the process of design for finite and infinite life under reversed stresses in detail.
[6]

OR

a)   Define notch sensitivity. Explain its significance in design of components subjected to fluctuating loads.
[6]

b)   A plate made of steel 20C8 (Sut = 440 N/mm²) in hot rolled and normalised condition is shown in Fig.1. It is subjected to a completely reversed axial load of 30 kN. The notch sensitivity factor (q) can be taken as 0.8 and the expected reliability is 90%. The size factor is 0.85. The factor of safety is 2. Determine the plate thickness for infinite life. Refer following Fig.1 to 4.
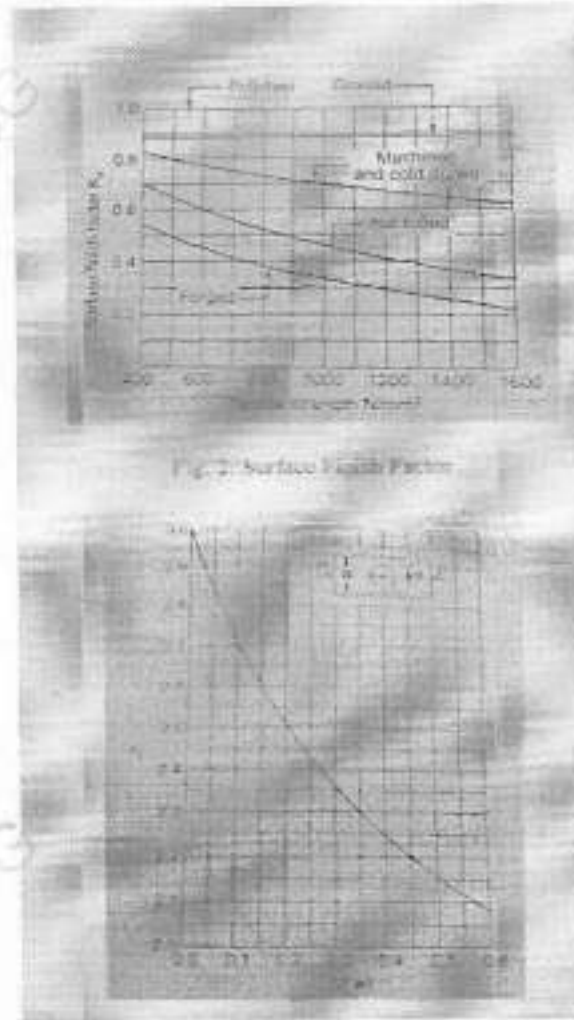[10]

Fig. 5.28
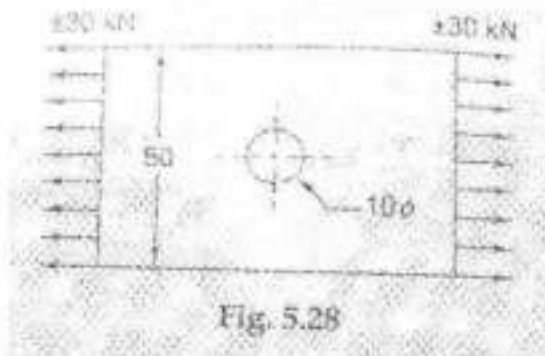
Fig.3: Stress Concentration Factor (Rectangular plate with transverse hole in tension or compression)

Reliability R(%)	Kc
50	1.00
90	0.897
95	0.868
99	0.814
99.9	0.753
99.99	0.659

Fig. 4: Reliability factor

Q2) a) Explain general principles of design for assembly. [6]

OR

a) Define static and dynamic load carrying capacity and explain. [6]

b) A machine shaft rotating at 720 rpm and transmitting power from the pulley P to the spur gear G is shown in Fig.5. The belt tensions and the gear tooth forces are as follows:

P_1=498 N, P_2=166 N, P_t=497 N, Pr=181 N

The weight of the pulley is 100 N. The diameter of the shaft at bearings B_1 and B_2 is 10 mm and 20 mm respectively. The load factor is 2.5 and the expected life for 90% of the bearings is 8000 h. Select single-row deep groove ball bearings at B_1 and B_2. [10]
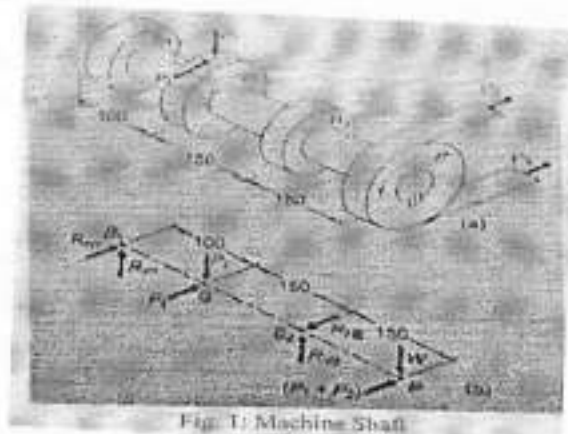
Refer fig.6 for data.

Fig. 1: Machine Shaft

Principal Dimensions (mm)			Basic Load Ratings (N)		Designation
d	D	B	C	Co	
10	19	5	1480	630	61800
	26	8	4620	1960	6000
	30	9	5070	2240	6200
	35	11	8060	3750	6300
12	21	5	1430	695	61801
	28	8	5070	2240	6001
	32	10	6890	3100	6201
	37	12	9750	4650	6301
20	32	7	2700	1500	61804
	42	8	7020	3400	16404
	42	12	9360	4500	6004
	47	14	12700	6200	6204
	52	15	15900	7800	6304
	72	19	30700	16600	6404

Fig. 6: Parameters for Single-row deep groove ball bearings

Q3) a) Explain Raimondi and Boyd method relating performance of bearings to dimensionless parameters. **[8]**

OR

a) Describe basic theory of Hydrodynamic lubrication. **[8]**

b) The following data is given for a 360° hydrodynamic bearing. **[10]**

Bearing diameter: 50.02 mm

Journal diameter: 49.93 mm

Bearing length: 50 mm

Journal speed: 1440 rpm

Radial load: 8 kN

Viscosity of lubricant: 12 cP

The bearing is machined on a lathe from bronze casting, while the steel journal is hardened and ground. The surface roughness (cla) values for turning and grinding are 0.8 and 0.4 microns respectively. For thick film hydrodynamic lubrication, the minimum film thickness should be five times the sum of surface roughness values for the journal and bearing.

Calculate:

i) The permissible minimum film thickness.

ii) The actual film thickness under operating conditions.

iii) Power lost in friction.

Use Fig.7 for data

l/d	ε	h_o/C	S	φ	(r/C)f	$Q/(rCn_sl)$
	0.4	0.6	0.264	63.10	5.79	3.99
	0.6	0.4	0.121	50.58	3.22	4.33
1	0.8	0.2	0.0446	36.24	1.70	4.62
	0.9	0.1	0.0188	26.45	1.05	4.74
	0.97	0.03	0.0047	15.47	0.514	4.82

Q4) a) Explain the different types of gear tooth failure. [7]

OR

b) Derive an expression for the Beam strength of Spur gear and State the assumptions made for the same. [7]

c) A pair of spur gears with 20° full depth involutes teeth consists of a 24 teeth pinion meshing with 48 teeth gear. The module is 6 mm and face width is 60 mm. The material for the pinion and gear is steel with an ultimate tensile strength of 450N/mm². The gears are heat treated to a surface hardness of 250 BHN. The pinion rotates at 1000 rpm and the service factor for the application is 1.5. Assume that velocity factor accounts for the dynamic load and the factor of safety is 2. Determine the rated power that gear can transmit. Use Y for 24 teeth = 0.337. [11]

Q5) a) A pair of parallel helical gears consistes of an 18 teeth pinion meshing with 63 teeth gear. The helix angle is 23° and normal pressure angle is 20°. The normal module is 3 mm.

Determine:

i) The transverse module

ii) The transverse pressure angle

iii) The axial pitch

iv) The pitch circle diameters of the pinion and the gears

v) The center distance

OR

b) A pair of straight tooth bevel gears is mounted on shafts, which are intersecting at right angles. The number of teeth on pinion and gear are 21 and 28 respectively. The pressure angle is 20°. The pinion shaft is connected to an electric motor developing 5kW rated power at 1440 rpm. The srevice factor for the application is 1.5. The material for the pinion and gear is steel with an ultimate tensile strength of 600N/mm². The gears are heat treated to a surface hardness of 300 BHN. The module is 4 mm and face width is 20 mm. respectively. The axial thickness of gear blank is 15 mm. The gears are machined by hobbing process to confirm to grade 8,

For grade 8, Error e = 16+1.25(m+0.25 $\sqrt{}$ d) in microns and Y for 26 teeth = 0.344,

Y for 27 teeth = 0.348, Determine the factor of safety for bending and pitting. [10]

c) Explain with neat sketch force analysis of helical gear. [6]

Q6) a) Derive Lewis equation for beam strength of Bevel gear. [6]

OR

b) Explain the force analysis in the design of worm and worm wheel drive. [6]

c) Worm and worm wheel drive is designated as 2/41/10/8. The drive is used to obtain speed reduction of 20.5 from an input speed of 1450 rpm. Material for worm wheel is sand cast and chilled phosphor bronze while the worm is made of case hardened alloy steel. Determine the power transmitting capacity based on beam' strength. Use following data:

Speed factor for strength of worm $(Xb_1) = 0.24$, Speed factor for strength of worm wheel $(Xb_2) = 0.44$, Bending stress factor for worm $(Sb_1) = 33.11$, Bending stress factor for worm wheel $(Sb_2) = 6.4$. [10]

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T.E. (Mechanical) (Part - III) (Semester - VI) (Revised) Examination, May - 2017
INTERNAL COMBUSTION ENGINES
Sub. Code : 66841

Day and Date : Saturday, 06 - 05 - 2017
Time : 2.00 p.m. to 5.00 p.m.

Total Marks : 100

Instructions :
1) Attempt all the questions.
2) Make Suitable assumptions if necessary and clearly mention them.
3) Figures to right indicate full marks.

Q1) Solve any two from the following:

a) Classify I.C. Engines.

[8]

b) Write down the applications of 2-Strokes gasoline & diesel engines and 4-Strokes gasoline & diesel engines.

[8]

c) Draw and explain valve timing diagram for 4-Strokes C.I. engine. [8]

Q2) Solve the following:

a) Derive an equation for air fuel ratio for simple carburetor by neglecting the effect of compressibility.

[9]

OR

a) Classify solid injection system for diesel engine. Explain common rail system and distributor system.

[9]

b) A four-cylinder, four-stroke square engine running at 40 rev/s has a carburetor ventury with a 3 cm throat. Assuming the bore to be 10 cm, volumetric efficiency of 75%, the density of air to be 1.15 and coefficient of air flow to be 0.75. Calcualte the suction at throat.

[9]

P.T.O.

Q3) Solve any two from the following:

a) Explain the stages of combustion in S.I. engine with P-θ diagram. [8]

b) Explain ignition lag and flame propagation in S.I. engine. [8]

c) Explain the types of combustion chambers for S.I. engine and highlights its requirements. [8]

Q4) a) Explain about the good characteristics of CI engine combustion chambers. State advantages of them. [8]

b) Compare air swirl in CI Engines with turbulence in SI Engines. [8]

OR

b) Explain the term 'Delay period' as referred to CI engines and its importance. [8]

Q5) a) List the advantages and disadvantages of supercharging of diesel engine. [7]

b) A Six cylinder SI Engine operates on four stroke cycle. The bore of each cylinder is 80 mm and stroke is 100 mm. the clearance volume per cylinder is 70 cc. At a speed of 4000 rpm the fuel consumption is 20 kg/hr and torque is 150 N.m. Calcualte: [9]

i) Brake Power.

ii) Brake Mean Effective Pressure.

iii) Brake Thermal Efficiency.

iv) Air standard and its relative efficiency.

Assume Calorific value of fuel as 43,000 kJ/kg.

Q6) Write Short notes on any three: [18]

a) Emission Norms.

b) Catalytic convertors.

c) EGR Techniques.

d) Evaporative emissions and their control.

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Seat
No.

T.E. (Mechanical) (Part - III) (Semester - VI) (Revised) Examination, May - 2018
INDUSTRIAL MANAGEMENT & OPERATIONS RESEARCH
Sub. Code: 66837

Day and Date : Thursday, 03 - 05 - 2018

Total Marks : 100

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

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data, if necessary.
4) All questions are to be solved on one answer book only.

Q1) Attempt any four:

[20]

a) Explain in brief principle of organizing.

b) What is the selection process followed in public sector undertakings?

c) Prepare a suitable plan of training to fresh engineering graduates for a large scale manufacturing concern.

d) Discuss the relationship between leadership, motivation & productivity.

e) How does Herzberg's theory of motivation differs from Maslow's theory of motivation?

Q2) Attempt any two:

[12]

a) What factors are studied in conducting feasibility report writing of any propsed business activity?

b) How market assistance is rendered by government to small scale industries?

c) Explain postive and negative impact of globalization on small scale industries in India.

P.T.O.

Q3) Write short notes on any three: [18]

a) Difference between Marketing & selling concept.

b) Types of Advertising.

c) Objectives of Purchasing.

d) Evaluation of Purchase Performance.

e) Cost control and Cost reduction.

Q4) Attempt any three: [18]

a) What is a Operations Research model? Discuss the advantages of limitation of good Operations Reseach model.

b) Use Graphical method to solve the following:

Maximize $Z = 9X_1 + 4X_2$

Subjected to constraints,

$$7X_1 + 5X_2 \leq 70,$$
$$4X_1 + 6X_2 \leq 48$$
$$3X_1 + 6 X_2 \leq 42$$
$$X_1, X_2 \geq 0$$

c) A sheet metal operation company manufactures four models of tray. Each tray is first cut on cutting process in the trimming shop and next sent to the soldering shop where edges are joined. The average time in minutes for each job in theses shops is as follows:

Shop	Tray A	Tray B	Tray C	Tray D
Trimming shop	2	2	3	4
Soldering shop	4	6	7	8

Because of limitations in capacity of the plant, no more than 700 minutes/day of capacity is expected in Trimming shop and 1400/day minutes of capacity is expected in the soldering shop in the next six months. The contribution from sales for each tray is as given below: Tray A : Rs. 12/- per unit, Tray B : Rs. 12/- per unit, Tray C : Rs. 12/- per unit and Tray D : Rs. 12/- per unit. Formulate LPP.Suggest suitable method for solution to LPP.

d) Use simplex to solve the following problem and obtain initial and second feasible solution (two simplex tables only)

Minimise $Z = 6X_1 + 5X_2 + 4X_3$

Subjected to constraints $6X_1 + 5X_2 + 10X_3 \le 76$

$8X_1 + 3X_2 + 6X_3 \le 50$

$X_1, X_2, X_3 \ge 0$

Q5) Attempt any two: [14]

a) Indicate how you will test for optimality of initial feasible solution of a transportation problem.

b) The unit transportation cost along with capacity and requirements from a factories to a warehouses is as given below:

Factory	Warehouse				Capacity
	1	2	3	4	
A	11	13	17	14	500
B	16	18	14	10	600
C	21	24	13	10	800
Requirements	400	450	550	600	

Obtain initial basic feasible solution by least cost method & VAM.

c) A company has four workers and five jobs. Time taken by each worker to complete each job in minutes machine given in the matrix below. Solve the assignment problem & estimate the total time to complete all jobs.

Worker	Jobs				
	A	B	C	D	E
1	20	22	8	4	16
2	14	22	20	28	24
3	10	12	18	24	18
4	26	30	22	20	14

Q6) Write short notes on any three: [18]

a) Discuss the difference between decision under certainty, under uncertainty and under risk.

b) The following matrix gives the payoff (in Rs.) of different strategies against events.

| Strategies	Events		
	E_1	E_2	E_3
S_1	8000	70000	50000
S_2	50000	45000	40000
S_3	25000	10000	0

What will be your decision under the following approaches:

i) Optimistic Criterion

ii) Pessimistic Criterion

iii) Laplace Criterion

iv) Hurwicz Criterion ($\alpha = 0.4$)

c) Draw the project network for the following activities and determine critical path and project duration.

Activity	Preceding activity	Duration (days)
A	-	16
B	A	18
C	B	14
D	A	30
E	C,D	8
F	E	2
G	D	8
H	E, G	10
I	H,F	8

d) Determine optimal sequence, elapsed time and idle time of the following eight jobs on the machine M1 and M2 used in the same sequence to process these jobs.

Machines	Jobs							
	J1	J2	J3	J4	J5	J6	J7	J8
M1	5	4	22	16	15	11	9	4
M2	6	10	12	8	20	7	2	21
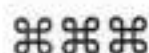
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T.E. (Mechanical) (Semester - VI) (Revised) Examination, May - 2018
INDUSTRIAL FLUID POWER
Sub. Code : 66838

Day and Date : Saturday, 05 - 05 - 2018
Time : 2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions :
1) All questions are compulsory.
2) Make suitable assumptions if required and state it clearly.
3) Draw neat diagrams/sketches wherever necessary.
4) Figures to the right indicate full marks.

Q1) Solve any two:

a) Differentiate between hydraulics and pneumatics. [7]

b) List applications of fluid power systems. [7]

c) Draw the symbols for the following elements: [7]
   i) Sequence Valve.
   ii) Four way, three position-open centre pilot operated D. C. valve.
   iii) Muffler.
   iv) Single acting intensifier.
   v) Single acting spring return actuator.
   vi) Twin pressure valve.
   vii) Air motor.

Q2) Solve any three:

a) What is the difference between a fixed displacement pump and a variable displacement pump? Draw a neat sketch of balanced vane pump. [6]

b) Mention the different types of mountings used in fixing the hydraulic cylinders. [6]

c) What are the important locations of filters? Explain the advantages and disadvantages of each location. [6]

d) Explain with neat sketch working of Double acting Intensifiers. [6]

P.T.O.

Q3) Solve any three:

a) Explain different actuation mechanisms for D.C. valve in hydraulic systems.
  [6]

b) Draw schematically a Pressure reducing valve and explain its working.[6]

c) Explain the working of Pressure compensated flow control valve with neat sketch.
  [6]

d) Explain the requirements of pressure control, direction control and flow control valves used in hydraulic systems.
  [6]

Q4) Solve any three:

a) Compare air motor with electric motor.
  [6]

b) With the help of neat sketch explain the working of air lubricator. [6]

c) Explain with the help of neat sketch the construction and working of time delay valve.
  [6]

d) Explain the working of 4/2 seat type Direction control valve with a neat sketch.
  [6]

Q5) Solve any three:

a) Explain rapid traverse and feed circuit in hydraulic system. [6]

b) Explain the Meter-in circuit used in hydraulic system. [6]

c) With the aid of circuit diagram explain the working principle of impulse operation circuit in pneumatics.
  [6]

d) Explain sequence circuit of type A+B+ A-B- in pneumatic system. [6]

Q6) Solve any two:

a) Explain Hydraulic servo system for linear motion with neat sketch. [7]

b) Explain Troubleshooting of Pneumatic system. [7]

c) What is general principle of fludic gate? Explain proportional amplifier.[7]

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Seat
No.

T.E. (Mechanical) (Part-III) (Semester-VI) (Revised)
Examination, May - 2018
METROLOGY AND QUALITY CONTROL
Sub. Code : 66839

Day and Date : Tuesday, 08 - 05 - 2018   Total Marks : 100
Time : 2.30 p.m. to 5.30 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) Solve any two of the following: [18]

a) Explain the terms with neat sketch:

   i)   Wear allowance

   ii) Limit gauge

b) Explain with neat sketch the types of fits and its application.

c) Find out the two limits for a hole and shaft pair designated as 60 H7 m 7 with following data and state the type of fit.

   i)   60 mm lies between dia. steps of 50-80 mm

   ii) i- is standard tolerance unit $= 0.45 D^{\frac{1}{3}} + 0.001D$

   iii) For grade IT7 tolerance $= 16i$

   iv) Fundamental deviation of m shaft (IT7 - IT6), IT6 $= 10i$

   v)   Fundamental deviation of H-hole $= 0$

Q2) Solve any two of the following: [16]

a) State advantage and disadvantages of mechanical comparator over pneumatic comparator.

P.T.O.

b) A set of angle gauges consist of the following gauges

   i)   1°, 3°, 9°, 27°, 41°, 90°

   ii)   1', 3', 9', 27'

   iii) 3", 6", 18", 30"

   Select suitable angles gauges required to build the following angles:

   1)   11° 22'

   2)   28° 36' 15"

   3)   43° 41' 27"

   4)   98° 24' 15"

c) State the essential requirements for accuracy in the construction of sine bar. How use sine bar angle measurement? Why use of sine bar is not recommended for angle larger than 45°.

Q3) Solve any two of the following: [16]

   a) State the principle of interferometry and explain with neat sketch N.P.L. Interferometer.

   b) Explain principle, construction and working of Taylor Hobson Talysurf with neat sketch.

   c) What is the straight edge? Explain with neat sketch use of straight edge for checking flatness and straightness.

Q4) Solve any two of the following: [16]

   a) How will you measure the following elements of spur gear?

      i)   Run out

      ii) Tooth profile

   b) Derive an expression for effective diameter measurement by 3-Wire method for external threads.

   c) Define the pitch of screw thread and describe the use of pitch measuring machine with a neat sketch.

Q5) Solve any two of the following: [16]

a) Explain the concept of quality; give objectives and importance of quality control.

b) How failure, prevention and appraisal cost is related to each other? Explain with Graphs.

c) What is quality control? What are different tools used to solve the quality control issues? Explain two of them with an example.

Q6) Solve any two of the following: [18]

a) Discuss advantages and limitations of 100% inspection and sampling inspection.

b) Explain the importance of statistical method in quality control and also explain characteristics of normal distribution curve.

c) A machine is working to a specification 12.58 ± 0.05 mm a study of 25 consecutive pieces shows the following measurements. Construct the $\bar{X}$ and R chart; calculate process capability and Comment on the process (For sample size of 5 take $A_2 = 0.58$, $D_4 = 2.11$, $D_3 = 0$, $d_2 = 2.326$).

1st day	2nd day	3rd day	4th day	5th day
12.54	12.58	12.61	12.57	12.57
12.58	12.57	12.60	12.61	12.60
12.62	12.60	12.64	12.56	12.62
12.56	12.60	12.58	12.59	12.61
12.59	12.61	12.64	12.59	12.58

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Seat No.	

T.E. (Mechanical) (Semester - VI) (Revised) Examination, May - 2018
MACHINE DESIGN - II
Sub. Code :66840

Day and Date : Saturday, 12-5-2018
Time :2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions :
1) Figures to the right indicate full marks.
2) Assume suitable data wherever necessary.
3) Use of Non - programmable calculator is allowed.

Q1) a) Draw Soderberg and Goodman fatigue diagram. Explain its significance.[8]

OR

a) Describe the process of fatigue design under combined stresses. [8]

b) A machine shaft carries a pulley between two bearings. The bending moment at the pulley varies from 200 N-m to 600 N-m and the torsional moment in the shaft varies from 70 N-m to 200 N-m. The frequencies of variation of bending and torsional moments are equal to the shaft speed. The shaft is made of steel FeE 400 (Sut = 540 N/mm² and Syt = 400 N/mm²) and the corrected endurance strength of shaft is 200 N/mm². Determine the diameter of the shaft using factor of safety of 2. [10]

Q2) a) Explain 'Stiffening factor' in design of plastics. What are various ways of stiffening in plastics? [6]

OR

a) Explain significance of DFM and its effect on design quality. [6]

b) A single row deep groove ball bearing No. 6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. Use Table 1 for data. [10]

P.T.O.

Principal Dimensions (mm			Basic Load Ratings (N)		Designation
d	D	B	C	Co	
10	19	5	1480	630	61800
	26	8	4620	1960	6000
	30	9	5070	2240	6200
	35	11	8060	3750	6300
15	24	5	1560	815	61802
	32	9	5590	2500	6002
	35	11	7800	3550	6202
	42	13	11400	5400	6302
20	32	7	2700	1500	61804
	42	8	7020	3400	16404
	42	12	9360	4500	6004
	47	14	12700	6200	6204

Table 1 : Parameters for Single - row deep groove ball bearings.

$\left(\dfrac{F_a}{C_0}\right)$	$\left(\dfrac{F_a}{F_r}\right) \leq e$		$\left(\dfrac{F_a}{F_r}\right) > e$		e
	X	Y	X	Y	
0.025	1	0	0.56	2.0	0.22
0.040	1	0	0.56	1.8	0.24
0.070	1	0	0.56	1.6	0.27
0.130	1	0	0.56	1.4	0.31
0.250	1	0	0.56	1.2	0.37
0.500	1	0	0.56	1.0	0.44

Table 2: X and Y factors

Q3) a) Derive Striback's Equations. [8]

OR

a) What are the various Tribological considerations used in design of bearings. [8]

b) A following data is given for a 360° hydrodynamic bearing. [8]

Journal diameter = 100 mm

Bearing length = 100 mm

Radial load = 50 KN

Journal speed = 1440 rpm

Radial clearance = 0.12 mm

Viscosity of lubricant = 16Cp.

Calculate:

i) Minimum oil film thickness

ii) Coefficient of friction

iii) Power lost in friction

Refer following data Table:

l/d	ε	h/C	S	φ	(r/C)f	Q/(rCn₁l)
	0.4	0.6	0.264	63.10	5.79	3.99
	0.6	0.4	0.121	50.58	3.22	4.33
1	0.8	0.2	0.0446	36.24	1.70	4.62
	0.9	0.1	0.0188	26.45	1.05	4.74
	0.97	0.03	0.0047	15.47	0.514	4.82

Q4) a) Explain the term static and dynamic loads on gear tooth. Describe various parameters which contribute dynamic load. [7]

OR

-3-

b) Explain the different methods of gear lubrication system. [7]

c) Design a pair of spur gears with 20° full depth involute teeth consist of 17 teeth pinion meshing with 68 teeth gear. The module and face width are 2.5 and 25 mm respectively. The gears are machined to meet the specification of grade 10 and heat treated to surface hardness of 250 BHN. For grade 10, $e = 32 + 2.5 (m + 0.25 \sqrt{d})$ in μm. Use M.F.Spotts approach for the dynamic load. Determine: [11]

   i) The optimum speed for maximum power transmitting capacity.

   ii) The optimum power transmitted by the gears at the above speed.

Q5) a) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20° and the helix angle is 25°. The normal module is 4 mm and the face width is 40 mm. The pinion and the gear is made of steel 40C8 ($S_{ut} = 600 N/mm^2$) and heat treated to a surface hardness of 300 BHN. The service factor and factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. Use Y for 26 teeth = 0.344 and Y for 27 teeth = 0.348. [10]

OR

b) 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]

c) Explain with the help of neat sketch force analysis of helical gear. [6]

Q6) a) Explain with neat sketch the following terms in reference to bevel gears.[8]

   i) Pitch cone

   ii) Pitch angles for pinion and gear

   iii) Cone distance

   iv) Cone distance

OR

b) Discuss the thermal consideration in the design of worm and worm wheel drive. [8]

c) A pair of worm gear is designated as 1/40/10/4 has an effective surface area of 0.25 m². A fan is mounted on the worm shaft to circulate air over the surface of the fins. The coefficient of heat transfer can be taken as 25 W/m² °C. The permissible temperature rise of the lubricating oil above the atmospheric temperature is 45°C. The coefficient of friction is 0.035. The worm shaft is rotating at 1440 rpm and the normal pressure angle is 20°. Calculate the power transmitting capacity based on thermal considerations. [8]

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Seat No.

T.E. (Mechanical) (Part-III) (Semester - VI) (Revised) (New) Examination, May - 2019
INDUSTRIAL MANAGEMENT AND OPERATIONS RESEARCH
Sub. Code: 66837

Day and Date : Monday, 13- 05 - 2019   Total Marks : 100
Time : 10.00 a.m. to 01.00 p.m.

Instructions :
1) All question are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data if necessary.

Q1) Attempt any four from the following :   [20]

   a) What are the significant aspects of environment which must be forecasted for the purpose of planning?

   b) Discuss managerial strategy using Herzberg's theory for motivating employees.

   c) Compare recruitment and selection.

   d) What causes distortion in upward communication? How can these distortions be minimized?

   e) What is control? How is it related with other functions of management?

Q2) Attempt any two from the following :   [12]

   a) Explain in brief steps involved in feasibility report writing for a product in order to set up a small-scale industry?

   b) What are the sources of new ideas? Explain with examples.

   c) What are the possible reasons for accidents in different sections of a forging unit? Which preventive measures do you suggest to prevent those accidents?

P.T.O.

Q3) Write short notes on any three : [18]

    a) Types of markets

    b) Salesmanship

    c) Functions of Purchase department

    d) Cost control.

Q4) Attempt any three from the following : [18]

    a) Discuss in brief the role of OR in decision making.

    b) Use Graphical method to solve the following LPP

       Minimize $Z = 60x_1 + 40x_2$

       subjected to constraints,

$$30x_1 + 10x_2 \geq 240,$$
$$10x_1 + 10x_2 \geq 160$$
$$204x_1 + 60x_2 \geq 480$$
$$x_1, x_2 \geq 0$$

    c) A firm plans to purchase at least 200 quintals of scrap containing high quality metal X and low quality metal Y. Scrap can be purchased from two suppliers A & B. Scrap must contain 100 quintals of metal X and no more than 35 quintals of metal Y. The percentage of X & Y in metals. in terms of weight in the scrap supplied by A & B is given as

Metal	Supplier A	Supplier B
X	25%	75%
Y	10%	20%

    The prices of A's Scrap is Rs. 200 per quintal and that of B's is Rs 400 per quintal. Formulate the LPP to determine the quantity to be purchased from each supplier so that the cost is minimum.

    d) What is difference between simplex solution procedure for a Maximization and Minimization problem?

Q5) Attempt any two from the following : [14]

    a) State three different methods used to obtain initial basic feasible solution in transportation problem. Comment on each method.

b) The four different jobs are to done on four different machines. Table indicates cost of producing job *i* on machine *j* in rupees. Assign jobs to different machine to minimize the cost.

Jobs	Machines			
	M1	M2	M3	M4
J1	5	7	11	6
J2	8	5	9	6
J3	4	7	10	7
J4	10	4	8	3

c) Find an optimal solution to the following transportation problem

From	Transportation cost in Rs Per unit				Supply
	To				
	1	2	3	4	
A	7	3	8	6	60
B	4	2	5	10	100
C	2	6	5	1	40
Demand	20	50	50	80	

Q6) Attempt any two from the following : [18]

a) The following matrix gives the payoff of different strategies by research organization for variants of products S_1, S_2, S_3 and S_4 against different conditions of estimated levels of sales N_1, N_2, N_3, and N_4

	N1	N2	N3
S1	30,000	10,000	10,000
S2	40,000	15,000	5,000
S3	55,000	20,000	3,000

What will be your decision under the following approach.

i) Pessimistic criterion

ii) Optimistic criterion

iii) Regret criterion

iv) Laplace criterion

v) Hurwicz criterion with a = 0.6

b) The following table gives the activity time of a certain project together with immediate predecessor requirements.

Activity	Immediate predecessor	Time in days
A	---	15
B	---	15
C	A	3
D	A	5
E	B,C	8
F	B,C	12
G	E	1
H	E	14
I	D,G	3
J	F, H, I	14

i) Draw the network

ii) Determine the expected project completed time

iii) 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 M1, M2, M3 Entries give the time in hours on the machine.

		Jobs						
		A	B	C	D	E	F	G
Time	M1	3	8	7	4	9	8	7
on M/C	M2	4	3	2	5	1	4	3
	M3	6	7	5	11	5	6	12

What is the minimum elapsed time?

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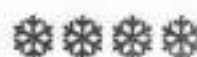
Seat
No.

T.E. (Mechanical) (Part - III) (Semester - VI) (New) (Revised) Examination, May - 2018
INTERNAL COMBUSTION ENGINES
Sub. Code : 66841

Day and Date : Tuesday, 15 - 05 - 2018

Total Marks : 100

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

Instructions :
1) Attempt all the questions.
2) Make suitable assumptions if necessary and clearly mention them.
3) Figures to the right indicates full marks.

Q1) a) Define the following terms. **[8]**

    i) Volumetric Efficiency.

    ii) Square Engine.

    iii) Stroke.

    iv) Compression ratio.

OR

  b) Classify IC Engine and explain each type with examples. **[8]**

  c) Explain with neat sketch valve timing diagram for high speed petrol engine. **[8]**

Q2) a) A simple jet carburetor is required to supply 4kg of air and 0.5 kg of fuel per minute. The Specific gravity of fuel is 0.75 and density of fuel is 750 kg/m^3, the air is initially at 1 bar and 300 k, Determine **[9]**

    i) The throat diameter of choke for a flow velocity of 100 m/s.

    ii) If velocity coefficient is 0.8, the coefficient of discharge for the fuel nozzle is 0.60, and Pressure drop across metering orifice is 0.80 of that of choke, calculate orifice diameter.

P.T.O.

b) What are the modern systems added in simple carburetor to become a complete Carburetor. [9]

OR

c) Explain solid injection system for CI engine and its types. [9]

Q3) a) Explain stages of combustion in SI engine with P-$\ominus$diagram. [8]

OR

b) Explain the following terms for SI engine. [8]

   i) Ignition lag.

   ii) Flame propagation.

   iii) Octane number.

   iv) HVCR.

c) What are the design requirements of SI engine combustion chamber? Explain any two types of combustion chambers. [8]

Q4) a) Explain the design considerations of CI engine combustion chambers. List the types of indirect combustion chambers. [8]

b) Compare between Induction swirl and compression swirl of CI engines. [8]

Q5) a) Explain the effects of engine variables on 'Delay period' as referred to CI engines and its importance. [8]

b) Compare abnormal combustion in CI Engines with SI Engines. [8]

OR

b) What are the various requirements of fuel injections stem for Diesel engines. [8]

Q6) a) List the types of superchargers used and their advantages for diesel engine.

[7]

b) In morse test with a four cylinder four stroke petrol engine the following data were observed for a particular speed setting.

BHP with all cylinder cut out = **32.0**, BHP with No.1 cylinder cut out = **21.6**, BHP with No.2 cylinder cut out = **22.3**, BHP with No.3 cylinder cut out = **22.5**, BHP with No.4 cylinder cut out = **23.0**, Estimate the IHP of the engine and mechanical efficiency.

[7]

c) Write note on Catalytic convertors.

[4]

Seat
No.

T.E. (Mechanical) (Part - III) (Semester - VI)
Examination, May - 2019
INDUSTRIAL FLUID POWER
Sub. Code: 66838

Day and Date : Wednesday, 15 - 05 - 2019   Total Marks : 100

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

Instructions :   1)   All questions are compulsory.
                 2)   Figure to the right indicates full marks.
                 3)   Assume suitable data, wherever necessary.

Q1) Attempt any Two

a)   Explain the advantages and limitations of hydraulic systems.   [7]

b)   Draw ISO/JIC symbols of any SEVEN components of fluid power systems   [7]

c)   Explain types of hydraulic fluids used and state the factors for selection.[7]

Q2) Attempt any THREE

a)   Explain the factors to be considered for selection of seal and causes of failure.   [6]

b)   Explain construction and working of balanced vane pump with neat sketch.   [6]

c)   Explain with a neat diagram working of a telescopic cylinder.   [6]

d)   Draw neat sketches of a single acting and double acting intensifier and state the differences between them.   [6]

Q3) Attempt any THREE

a) Explain the need of pressure, direction and flow control in fluid power system. [6]

b) Compare pressure relief valve and pressure reducing valve. [6]

c) What are the main types of direction control valve? Explain with symbol different center positions of them. [6]

d) Explain pressure and temperature compensated flow control valve with neat sketch. [6]

Q4) Attempt any THREE

a) Name any six components of pneumatic system. What are the factors considered while selecting them? [6]

b) Compare between hydraulic, air and electric motor. [6]

c) Explain construction and working of twin pressure valve with neat sketch. [6]

d) Draw and explain with a neat sketch of a Push button spring return 5/2 D.C. valve used in pneumatic system. [6]

Q5) Attempt any THREE

a) Derive the relationship between speed of a double acting cylinder during forward and return stroke with a regenerative circuit used. [6]

b) Draw a hydraulic counter balancing circuit. Use the standard components required for the circuit. Explain its working. [6]

c) Explain with circuit diagram (Position based) working of sequencing circuit for two double acting Air cylinders. [6]

d) Explain with a neat circuit diagram a pilot operated check valve used in pneumatic systems. [6]

Q6) Attempt any TWO

    a)   Explain Pneumatic servo system for linear motion with neat sketch. [7]

    b)   Explain maintenance, trouble-shooting and safety related to any three hydraulic components. [7]

    c)   Define fluidics. Explain any two proximity sensors. [7]

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Seat
No.

T.E. (Mechanical) (Part-III) (Semester - VI) (Revised)
Examination, May - 2019
METROLOGY AND QUALITY CONTROL
Sub. Code : 66839

Day and Date :Friday, 17- 05 - 2019.   Total Marks : 100
Time : 10.00 a.m. to 1.00 p.m.

Instructions :   1)   All questions are compulsory.
                 2)   Figures to the 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)   Explain with neat sketch types of Fits.

b)   What is Fundamental Deviation? Explain with the neat sketch Hole basis system and shaft basis system.

c)   Calculate tolerance and limits for hole shaft pair designated as $\varnothing 60$ H7 m7 and also determine the minimum and maximum clearance. The dimensions $\varnothing 60$ lies between the ranges 50-80 mm. Fundamental deviation for H-hole is zero. The fundamental deviation of m shaft = (IT7-IT6). The standard tolerance given by $i = 0.45 \sqrt[3]{D} + 0.001 D$ (micron)

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

a)   Describe with neat sketch, how standard rollers and balls can be used for angle measurement.

b)   With neat sketch discuss working principle, Advantage and limitations of Johansson Mikrokator.

c)   What is comparator? Classify the comparators. Describe the advantages and disadvantages of each type.

Q3) Attempt any two questions of the following.   [16]

a)   Explain with neat sketch the use of straight edge for checking flatness and straightness.

b)   Sketch following fringe pattern i) Flat ii) Concave iii) Ridged & illustrate two simple tests on optical flat which will reveal whether a surface is convex or concave.

c)   Explain with neat sketch use of level beam comparator for straightness.

Q4) Attempt any two questions of the following. [16]

a) Describe with neat sketch gear tooth vernier caliper. Derive an expression for measuring constant chord with gear tooth vernier caliper.

b) Explain with neat sketch run-out and backlash checking for spur gear.

c) Enumerate various errors in screw threads and sources to get them.

Q5) Attempt any two questions of the following. [16]

a) What is quality Assurance? Discuss the stages of quality assurance.

b) Explain "specification of quality". What are the factors that control the quality of design?

c) Explain with suitable example following quality control tools.

i) Cause & effect diagram

ii) Scatter diagram

Q6) Attempt any two question of the following. [18]

a) List various control charts with the their uses Explain any two from them.

b) Draw N-D Curve and discuss its importance in statistical quality control.

c) Following data is taken on the outside diameter of bearings. The group size is 8. Draw proper control chart and comment on the process. (For sample size of 8 take $A_2 = 0.577$, $D_3 = 0$, $D_4 = 2.114$)

Sr. No.	1	2	3	4	5	6	7	8
X	2.008	1.998	1.993	2.002	2.001	1.995	2.004	1.999
R	0.027	0.011	0.017	0.009	0.014	0.020	0.024	0.018

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Seat
No.

T.E. (Mechanical) (Semester-VI) (Revised) Examination,
MACHINE DESIGN-II
Sub. Code : 66840

Day and Date : Tuesday, 21 - 05 - 2019   Total Marks : 100
Time : 10.00 a.m. to 1.00 p.m.

Instructions :   1)   Figures to right indicate full marks to the question.
                  2)   Use of programmable calculator is allowed.
                  3)   Assume any data if necessary and state it clearly.

Q1) a)   With the help of S-N Curve, explain the endurance limit and its significance
        in the design.   [6]

OR

a)   Define fluctuating stress. Explain in detail the reasons of fatigue failure.
                                                                            [6]

b)   A transmission shaft carries a pulley midway between bearings. The
     bending moment at the pulley varies from 100 Nm to 150 Nm. The
     torsional moment in the shaft varies from 150 Nm to 350Nm. The
     frequencies of variation of bending and torsional moments are equal to
     the shaft speed. The shaft is made up of steel FeE400 (Sut=660N\mm^2
     syt=400 n/mm^2) The corrected endurance strength is 300N\mm^2.

     Determine the diameter of the shaft using a factor of safety=3   [10]

Q2) a)   State and explain design consideration of forging.   [6]

a)   Explain the role of friction, wear and lubrication in the design of bearing.
                                                                            [6]

OR

b)   A ball bearing operates on the following work cycle;   [10]

Element No.	Radial Load (N)	Speed (rpm)	Elemental time (%)
1	3000	720	30
2	7000	1440	50
3	5000	900	20

The dynamic load capacity of the bearing is 16.6 kN. Consider work cycle of 1 minute duration.

Calculate:

i) The average speed of rotation

ii) The equivalent radial load

iii) The bearing life in hours.

Q3) a) Explain Raimondi and Boyd method relating performance of bearing to dimensionless parameters. [8]

OR

a) Explain the following terms in relation to sliding contact bearing. [8]

i) Length to diameter ratio

ii) Unit Bearing Pressure

iii) Radial clearance

iv) Minimum film thickness

b) A following data is given to 360^0 hydrodynamic bearing. [10]

Bearing Diameter=45.00 mm,

Bearing length= 45.00 mm. Radial clearance=0.025 mm,

Journal Speed= 1500 rpm, Viscosity or Lubricant= 0.3435 Ns/m^2,

Sommerfield no.=0.386

-2-

Refer the following table:

l/d	€	h_o/C	S	θ	(r/C)f	Q/(rCn_s l)	Q_s/Q
	0.1	0.9	1.33	79.5	26.4	3.37	0.159
	0.2	0.8	0.631	74.02	12.8	3.59	0.280
1	0.4	0.6	0.264	63.10	5.79	3.99	0.497
	0.6	0.4	0.121	50.58	3.22	4.33	0.680

Determine:

   i)   Power lost in friction

   ii)   Load capacity of bearing

Q4) a) Explain the procedure of construction of gear construction.   **[8]**

OR

a) Derive an expression for beam strength or Lewis equation of spur gear tooth. State the assumption made for deriving the same.   **[8]**

b) A pair of spur gears with 20^0 full depth involute teeth consists of a 19 teeth pinion meshing with a 40 teeth gear. The pinion is mounted on a crankshaft of a 7.5 K W single cylinder diesel engine running at 1500 rpm. The driven shaft is connected to a two stage compressor. Both the gears are made of steel 40C8 ($S_u t=600N/mm^2$). The module and face width of gears are 4 mm and 40 mm respectively.   **[10]**

   i)   Using the velocity factor to account for the dynamic load, determine the factor of safety.

   ii)   If the factor of safety is 2 for pitting failure, recommend the surface hardness for the gear.

   iii)   If the gears are machined to meet the specification of grade 8, determine the factor of safety for bending, using Spott's equation. Take Cs=1.5 and Y=0.314 for 19 teeth.

For grade 8 error e=16+1.25 (m+0.25√d) in μm.

Q5) a) A pair of parallel helical gears consists of an 18 teeth pinion meshing with 63 teeth gear. The helix angle is 23^0 and normal pressure angle is 20^0. The normal module is 3 mm. Determine: **[10]**

   i)   The transverse module

   ii)   The transverse pressure angle

iii) The axial pitch

iv) The pitch circle diameters of the pinion and the gears

v) The center distance

OR

a) A pair of straight bevel gears consist of a 24 teeth pinion meshing with A 48 teeth gear. The module at the outside diameter is 6 mm and face width is 50 mm. The gears are made of grey cast iron FG 220 (S_{ut}=220 N/mm^2) The pressure angle is 20^0. the teeth are generated and assume that velocity factor accounts for the dynamic load. The pinion rotates at 300 rpm and the service factor is 1.5 Use Y for 26 teeth=0.344 and

Y for 27 teeth=0.348. Determine: [10]

i) Beam strength

ii) The static load that the gears can transmit with factor of safety of 2 for bending consideration.

iii) The rated power that the gears can transmit.

b) Derive an expression for the force analysis of the helical gear. [6]

Q6) a) Derive Lewis equation for beam strength of Bevel gear. [6]

OR

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

b) Worm and worm wheel drive is designated as2/41/10/8. The drive is used to obtain speed reduction of 20.5 from an input speed of 1450 rpm. Material for worm wheel is sand cast and chilled phosphor bronze while the worm is made of case hardened alloy steel. Determine the power transmitting capacity based on beam strength. [10]

Use following data:

Speed factor for strength of worm (X_{b1})=0.24

Speed factor for strength of worm wheel(X_{b2})=0.44

Bending stress factor for worm (S_{b1})=33.11

Bending stress factor for worm wheel (S_{b2})=6.4

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Seat
No.

T.E. (Mechanical Engineering) (Part - III) (Semester - VI) (Revised) Examination, May - 2019
INTERNAL COMBUSTION ENGINES
Sub. Code: 66841

Day and Date : Thursday, 23 - 05 - 2019   Total Marks : 100
Time : 10.00 a.m. to 1.00 p.m.

Instructions :   1)   All the questions are compulsory.
                   2)   Figure to the right indicates full marks.
                   3)   Use suitable data wherever required and state it clearly.
                   4)   Use of scientific non programmable calculator is allowed.

Q1) Solve any two of following.
    a)   Define the following: [8]
          i)   Cubic capacity   ii)   Stroke
          iii)   Cetane number   iv)   A/F ratio
    b)   Write classification of I.C. engine and explain each type, giving examples.
                                                                           [8]
    c)   Draw and explain port timing diagram for 2 stroke S.I. engine.   [8]

Q2) Solve any two of following.
    a)   Explain with neat sketch CRDI system in details.   [8]
                                    OR
          Derive equation for air fuel ratio for simple carburetor by neglecting
          effect of compressibility.   [8]
    b)   A simple jet carburetor is required to supply 5 kg of air and 0.5 kg of fuel
          per minute. The fuel specific gravity is 0.75. The air is initially at 1 bar
          and 300k. Calculate the throat diameter of choke for a flow velocity of
          100m/s. velocity coefficient is 0.8. If the pressure drop across the fuel
          metering orifice is 0.80 of that of the choke, calculate orifice diameter
          assuming, Cdf = 0.60 and Υ = 1.4.   [8]

Q3) Solve any two of the following.
    a)   What is octane number? How it is determined? What are the additives
          used to improve the octane number?   [8]
    b)   Explain the effects of various engine variables on detonation.   [8]
    c)   Write in details the various mixture requirements of S.I. engine to be
          fulfilled by carburetor.   [8]

Q4) Solve any two of following:

a) Explain the types of combustion chambers for C I engines and highlight its requirements. [8]

b) Which are the different methods of generating air swirl in C.I. Engine combustion chamber? Explain any one method with neat sketch. [8]

c) Explain the stages of combustion in C.I. engines with p-θ diagram. [8]

Q5) Solve the following:

a) Define: [8]
   i) Performance curve   ii) Mechanical efficiency
   iii) Break thermal efficiency   iv) BSFC

<center>OR</center>

What do you mean by heat balance sheet of I.C. Engine? Explain how engine heat balance sheet is prepared. [8]

b) Following data relate to 4-cylinder four stroke petrol engine. Air fuel ratio by weight = 16:1, calorific value of fuel = 45200 KJ/Kg, mechanical efficiency = 82%, air standard efficiency=52%, relative efficiency = 70%, volumetric efficiency = 78%, stroke/bore ratio = 1.25, suction conditions = 1 bar, 25 °C, rpm=2400 and brake power = 72 kW. [10]
Calculate:
   i) Compression ratio
   ii) Indicated thermal efficiency
   iii) Brake specific fuel consumption
   iv) Bore and stroke

Q6) Write short note on any three: [18]

a) Selection of I.C. engine for agriculture.

b) Morse test.

c) EGR for emission control.

d) Standard pollution control.

e) Alternative fuel for S.I. engine.

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